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FLIGHT and The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor
C. M. POULSEN

Managing Editor
G. GEOFFREY SMITH, M.B.E.

Chief Photographer
JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

COVENTRY: 8-10, CORPORATION ST. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.

BIRMINGHAM, 2: GUILDHALL BUILDINGS, NAVIGATION ST. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).

MANCHESTER, 3: 260, DEANSGATE. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.

GLASGOW, C.2: 26B, RENFIELD ST. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

Registered at the G.P.O. as a Newspaper.

No 1826. Vol. XLIV. December 23rd, 1943. Thursdays, One Shilling.

The Outlook

The Shape of Things to Come

EVEN aviation folk working 16 hours a day on war production must sit back occasionally and take a "breather." That some of them should, on such occasions, turn their minds to the day when we can, once more, design and produce aircraft for the good of mankind instead of for destruction is inevitable. Judging from the many utterances in speech and in print which have flooded the world lately, it is obvious that there is no unanimity concerning the shape post-war aircraft should take. Indeed, there could not be. Requirements will vary with localities, and design will be influenced by considerations other than purely technical and operational.

Apart from questions of size and shape, it is not yet clear whether the landplane or the flying boat is likely to be the answer. Our own view, for what it is worth, is that up to gross weights of 150,000 pounds or so, the landplane may be the more suitable type in most cases, although it is not safe to generalise too boldly, and that above that weight it may be that the flying boat will score. *Flight* has ever been a believer in marine aircraft, and in the early days, when the flying boat was more inferior to the landplane than it is now (water soakage added hundreds of pounds to the weight of the hull), our advocacy of this type of aircraft led to us being nicknamed "The Seaplane Journal."

But at any moment some new discovery or invention may upset all preconceived notions. If, for example, some really simple, cheap and safe form of assisted take-off should be introduced, the construction of the fantastically long runways and airports covering half a county might be rendered superfluous. The problem of safe alighting would remain, but the assumption is that the huge airports would be used mainly by long-range aircraft, and that, therefore, the weight would have been reduced considerably by the time the landing was made. In any event there has been considerable development in arrester gear, and still further progress seems not merely possible but likely.

In the meantime, it is interesting to examine what can be done by what might be called detailed refinement, without launching into the largely or entirely unknown realms of unorthodoxy, such as the all-wing type with its tricky stability and control problems. In this issue we publish some illustrations and facts about the Miles "X" type of landplane, the earlier and smaller model of which *Flight* first described as long ago as April, 1938. At that time the project appeared extremely daring, but now, nearly six years later, it rather strikes one as a logical putting together of known factors. In fact, it seems to be the sensible compromise between Mr. Chadwick's orthodox types for the next ten years (which Sir Frederick Handley Page said no one would buy) and the ultimate ideal of the all-wing machine which may arrive later. At any rate, the "X" does have this advantage that it can be built in fairly moderate sizes, while the all-wing must be large in order to accommodate the passengers within the depth of the wing.

The Air Training Corps

TO start a beneficial and enduring movement among the young is a rare achievement, and those who succeed in framing such an idea and then in putting it into practice may feel that their lives have certainly not been wasted. The late Lord Baden-Powell is the outstanding example of such an achievement. Few people alive now remember much about the defence of

Mafeking, which once made his name a household word, but the Boy Scout movement goes on, and will doubtless continue to go on in every country of the world, and will remain a monument to the memory of its founder.

Air Commodore Chamier has joined the eminent band of workers for youth whose dreams have come true, and whose inspiration remains a solid fact. His post as Inspector of the Air Training Corps is being discontinued, and his own connection with the movement thereby ceases, but the work itself is to endure. The Air Ministry has decided that the A.T.C. is so valuable that it is taking the organisation completely under its own wing, and has appointed a regular serving officer to be its Chief Commandant and Director-General. This must ensure that the Corps will be maintained through all the chances and changes which always follow the conclusion of a great war, and (though to say so sounds almost like a contradiction in terms) the founder of the movement could ask for no higher compliment than the decision which severs his own connection with the product of his brain and energy.

The Eastern Air Command

THE organisation of Air Forces evolved in the Mediterranean has proved so successful that it was immediately copied in the Metropolitan Air Force and in the U.S. Army Eighth Air Force, and now the same pattern has been followed by Admiral Lord Louis Mountbatten in the South East Asia Command. He has instituted the Eastern Air Command.

In this, however, he has stuck closer to the Mediterranean model than to the cases mentioned in Great Britain. The Metropolitan Air Force has now a Tactical Air Force, and the Americans have both a Strategical and a Tactical Air Force, but the British and Americans in Britain remain separate bodies. In the Mediterranean they have been amalgamated into one, and that is what has happened in the Eastern Air Command. Air Chief Marshal Sir Richard Peirse is at the head of the new Command, while under him is an American Second-in-Command (Major-General G. E. Stratemeyer), while the Strategical Force is under an American (Brigadier-General H. C. Davidson), and the Tactical Air Force is under Air Marshal Sir John Baldwin, who, as his title of rank indicates, is an officer of the Royal Air Force.

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Christmas Greetings from the Editor and Staff, with Sincere Thanks for the many Messages Received from Appreciative Readers

FOR DIPLOMATIC JOURNEYINGS: A new picture of an Avro York flying alongside a Lancaster. Mr. Eden flew the 1,260 miles from Cairo to Teheran in a York in 5½ hours, an average speed of 233 m.p.h.

WAR in the AIR

Russian Air Success at Cherkasy : Sequel to the Bombing of Rabaul : The Battle of Berlin Goes On

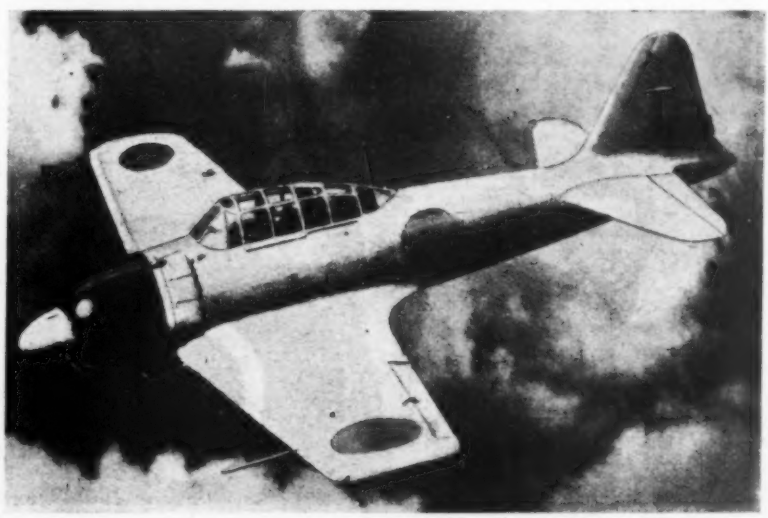
The crew of a U.S. Navy seaplane-tender fend off a 15-ton Catalina flying boat as it approaches the stern of the ship.

ONE remembers rather dimly that in the inter-war years it was Russia which first developed parachute troops, very much to the surprise of other countries, and that many military authorities and students saw no great future before such troops. The present war has shown that airborne forces are not to be used everywhere and every day, but that they can be very useful on occasions. Of course, parachutists are not the only form of airborne troops, not even the majority. They, above all others, are an arm of opportunity (as the horsed cavalry were once called); the majority travel in gliders or troop-carriers.

In the battle of Cherkasy the Russians made effective use of airborne forces, and units of the Seventh Guards Parachute Division were dropped from Douglas transport machines behind the forest which lies to the west and south-west of the town. There they joined up with the local partisans and attacked the Germans, creating a diversion. Other airborne troops were then landed to the east of the forest, near the Dnieper, and created further confusion. These surprise moves helped towards the capture of the town from the Germans. Dive-bombing by the *Luftwaffe* did not hold back the Russian troops. On the other hand, air support, probably by Stormoviks, helped the advancing Russian troops.

German troops had massed at Smyela, and the railways round that town were jammed with traffic. That was a great chance for Russian bombers—in fact it was the sort of work on which they specialise. Despite a barrage of *flak* and the efforts of German fighters, the Red bombers broke through to spread havoc on the railway lines.

The weather in Italy last week did not permit of much activity in that Peninsula by the heavy bombers of the Strategic Air Force. They found the weather in the Balkans more propitious, and devoted most of their attention to Yugoslavia and Greece. But the light and medium classes of machines contrived to keep in the air and to assist the ground troops. The wretched infantry have been having a most uncomfortable time in the rain, but it is a consolation to know that the Germans have likewise not lived in the lap of luxury. Probably they were fairly comfortable so long as they were able to remain in the caves which they had excavated in the mountains (the "winter line"), but when they were driven out of these their plight must have been worse than that of the British and Americans. The way of retreat for a force which cannot boast anything approaching equality in the air is a road of sorrow. So long as



IN THE FASHION: The clipped-wing Mitsubishi Zero known as the "Hap" by American airmen. Maximum speed is in the region of 350 m.p.h. The engine is an air-cooled Kinsei radial of 1,050 h.p.

WAR IN THE AIR

the retiring troops remain in the hills they may well escape the bombs and machine guns of the pursuing aircraft, but they have to put up with the weather and other hardships. When they reach the roads, where in previous wars easier circumstances might be expected, they are sure to come under the flail of the Tactical Air Force.

As for the heavies, early last week a force of 300 machines, bombers with fighter escort, flew across to Attica, determined to strike a really crippling blow on the ring of airfields round Athens and on the port of the Piræus. It was an exceptionally large congregation for the Mediterranean theatre of operations. They bombed the three airfields of Eleusis, Kalamaki and Tatoi, as well as the shipping in the Piræus, and shot down 12 out of 35 enemy fighters which tried to interfere. This unusually great effort must have had some particular object beyond its immediate objective, and developments are awaited with interest.

Towards the week-end, however, the weather permitted another serious effort by Allied bombers to hamper the traffic through the Brenner Pass. Fortresses attacked railways at both ends. Some flew across the main massif of the Alps to strike at Innsbruck, the capital of the Austrian Tyrol, which had never before experienced an air raid, while others went for the southern end and bombed the railways at Bolzano. This place has been bombed before a number of times. At the same time Liberators went for the viaduct over the river Avisio, a few miles to the south of Trento. Lightnings provided an escort, and all the Allied machines came safely home.

BOGGED DOWN: That rain and mud are holding up the offensive in Italy is evidenced by this picture of a Spitfire IX being moved by manpower.

Invasion of New Britain

A FEW weeks ago Gen. MacArthur indulged in a somewhat prolonged series of air attacks on Rabaul, in New Britain, the main Japanese base in the South West Pacific. The airfield was hammered time and again, and large numbers of Japanese aircraft were destroyed. The shipping in the harbour also suffered severely. The Japanese were evidently alarmed, and made strenuous efforts to reinforce the place, but only succeeded in providing more victims for the relentless American bombers.

Then followed a quiet interval, which was somewhat surprising. Bombardment on such a scale usually indicates that an attack in force, probably by all arms, is to follow. But for some time nothing very definite happened. No doubt the reconnaissance aircraft kept watch over Rabaul and the whole island of New Britain, and reported what was happening there. It was only a lull before the storm.

On December 14th Allied bombers went back to the island and dropped 356 tons of bombs on the area between Gasmata and Cape Merkus on its southern shore. Next morning, before dawn, Gen. MacArthur struck with (as the old saying went) horse, foot and artillery. In this case it was with land, sea, and air forces. Repeating the methods which had proved so successful in New Guinea and had led to the capture of Lae, troops in various forms of landing craft approached the beaches on the south of the island. They were escorted by an unusually strong naval force, mostly composed of destroyers. As soon as dawn broke Lightnings provided fighter cover overhead, skilfully arranged at various levels. A small force of Japanese dive-bombers and Zero fighters tried to attack the craft offshore, but did little damage, and suffered some losses from A.A. fire.

Landings had been planned at three points, and at two of them the Australians and Americans were successful in getting ashore, practically without opposition. At the third the troops came under such heavy enfilade fire that the attempt had to be given up. The naval forces kept guard against any interference by Japanese warships, and also bombarded enemy positions on the shore.

Following on the recent American

NEAR ENOUGH: Flt. Lt. A. H. Sager standing by the gaping hole made in his Spitfire fuselage while ground strafing over Holland. The radio was blown to pieces but the armour plate saved him from injury.

WAR IN THE AIR

ENEMY AIR LOSSES TO DEC. 18th

	Over G.B.	Continent	Middle East	N.W. Africa
Dec. 12	0	4	0	0
,, 13	0	0	0	0
,, 14	0	1	0	15
,, 15	0	0	0	5
,, 16	0	5	0	11
,, 17	0	0	0	7
,, 18	0	0	0	0
	0	10	0	38

Totals : West, 7,793; Middle East, over 5,757; North-West Africa, 3,783.

attack on the Gilbert islands, this invasion of New Britain marks a new step forward in the slowly growing offensive against Japan. It is most satisfactory that, though the greatest effort of the Allies must still be concentrated in Europe, they now have sufficient strength in the Pacific to press their offensive with growing force. The Japanese leaders are obviously alarmed, and well they may be. If the Allies can hit so hard with only one hand free, what will they be able to do when they can devote their full power to the Pacific war? We are still wondering what part the Japanese battle fleet intends to play in this war. So far it has been content to remain discreetly hidden, perhaps at Truk, while its cruisers, carriers and destroyers have been steadily reduced in number in a series of disastrous clashes with the Allies. Yet, sooner or later it must offer battle, and it can have but a poor chance.

Admiral Lord Louis Mountbatten has amalgamated the British and American Air Forces in India into one body under the command of Air Chief Marshal Sir Richard Peirse. The combined forces will be known as the Eastern Air Command. The Second-in-Command is the American Major General G. E. Stratemeyer. The Command is divided into two, a Strategical Air Force under the American Brig.-General H. C. Davidson, and a Tactical Air Force under Air Marshal Sir John Baldwin. This organisation follows the pattern of the N.W. Africa Air Forces, which has proved so successful in the Mediterranean.

In this connection it is interesting to see that recently the Japanese Air Force in Burma was stung into an attempt at reprisals for the constant harrying of communications in Burma by Allied aircraft. They raided Fort Hertz and an American base in Assam. They did slight damage, but killed a few civilian labourers, while they lost over 30 machines destroyed or damaged.

It has been disclosed in America that early in December the Germans made a surprise raid on the harbour of Bari in Italy and sank 17 Allied ships, causing 1,000 casualties to soldiers and sailors. Most of the ships had discharged their cargoes, but two vessels full of ammunition were set on fire, and the flames involved others.

Rommel, it seems, has now been put in charge of measures for the defence of Western Europe against the coming Allied invasion. It is presumed that this leaves Kesselring in supreme command of the German forces in Italy, although he is an officer of the *Luftwaffe* and not of the German Army. This is a strange arrangement, especially as the *Luftwaffe* has been playing the very smallest part in the recent fighting in Italy.

MORE JET PROPULSION : The six-barrelled rocket gun used by the Germans on the Russian front. It is a 12-ton version of the rocket gun which is reputed to be the German answer to Bomber Command.

BRITISH & U.S. AIR LOSSES TO DEC. 18th

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
Dec.					
12	0	3	0	0	0
13	0	0	1	2	3
14	0	1	0	0	5
15	0	0	0	0	4
16	0	41	1	0	2
17	0	0	0	0	1
18	0	0	0	0	5
	0	45	2	2	19

Totals : West, 8,752; Middle East, about 2,341; North-West Africa, 1,419.

THE OLD PILOT

I was an Air Force Pilot,
Who skimmed the azure blue,
To search the skies for Germans
And to give it to them, too.
When Jerry dived a'flaming,
I'd zoom aloft for joy.
Pardon the exuberant spirit
Of a twenty-year-old boy.

We held the skies for Britain,
In those days, long ago,
With Ball, Bishop and Collishaw,
And others, whom we know,
Their deeds, great blows for Victory,
Which made the Homeland ring,
And, when one fell a flaming wreck,
We sang, "God Save the King."

The 'planes we flew were flimsy,
Those Bristols, Nieuports, Spads.
Our kiddies oft have listened
To the stories of their Dads.
"Of how the Torch of Victory
Was seized, and held on high,
When we swept the German airmen
From the 1918 Sky."

Then I sat behind an oak desk;
Many years rolled by.
I pushed a pen or pencil,
Oft with a weary sigh.
I sometimes got to thinking,
Of the deeds I used to do,
And wishing I was back again,
Wearing Air Force Blue.

I'm now in Air Force Blue again,
Though it's only "Works and Bricks,"
But I mix among the young 'uns,
And I see them at their tricks.
There go the Spitfires, rolling,
Oh, how good it is to see,
And to know the young 'un in it
Is the ghost of what was me.

To the young 'un in the cockpit,
As the time goes speeding by,
He'll receive his order, "Grounded."
He'll be the same as I.
This, I have to say to him,
Whoever he may be,
'Twill not be any harder
Than that order was for me.

We've passed our "Torch of Victory"
To young hands, strong and true,
Whose modern deeds have proven
Their right to Air Force Blue.
They fly the British Roundells,
Against the Axis might.
The outcome is undoubted,
They'll win the Allied fight.

F.O. G. MADDOCK, R.C.A.F.

HERE AND THERE

Remote (Electoral) Control

AN Australian airman now stationed in London, F/O. Newton, has won an electoral campaign by proxy and been elected Labour member for Greenough, Western Australia, defeating Mr. W. Patrick, deputy leader of the opposition.

U.S. Air Appointment

CAPT. HAROLD B. MILLER, U.S.N., a veteran Navy pilot, has arrived in this country to take over the post of Naval Attaché for Air in London.

He succeeds Capt. A. I. Malstrom, who has now returned to the U.S.A.

B.O.A.C. Traffic Chief

MR. J. W. S. BRANCKER, son of the late Sir Sefton Brancker, has been appointed Traffic Director of British Overseas Airways Corporation in succession to Mr. Denis Handover from whom he takes over in the New Year.

Joining Imperial Airways in 1929, Mr. Brancker, who is now 33, became manager of their Continental section at the age of 27, and since then has been in charge of B.O.A.C.'s India and Burma region and, during the past year, their regional director for West Africa.

Sir Sefton Brancker, it will be remembered, was Director General of Civil Aviation when he lost his life in the R101 disaster in 1930.

Easily Avoided

ACCORDING to Mr. Wellwood Beall, engineering vice-president of the Boeing Aircraft Company, who has recently returned to America from a visit to Britain, the first German attacks with rocket-gun fighters caused considerable damage to the U.S. Eighth Air Force bombers, but it was soon found that mild evasive action was sufficient to reduce casualties.

Wright Memorial Lecture

SIR A. H. ROY FEDDEN, M.B.E., D.Sc., F.R.Ae.S., has accepted the invitation of the Council of the Royal Aeronautical Society to give the 32nd Wilbur Wright Memorial Lecture. The subject of the lecture, which will be delivered in May, 1944, will be announced later.

"TRIKE" TRAINER: By extending the cockpit cover and removing the nose armament, Bell Aircraft Corp. have converted the Airacobra into a two-seater trainer which will provide tricycle characteristics for pupil pilots. The conversion was evolved at the request of the U.S. Fourth Fighter Command.

A good idea of the importance of this annual aeronautical lecture is conveyed by the following list of notabilities who have read it in recent years:—

American:—Colonel F. P. Lahm, Mr. D. W. Douglas, Professor Th. Von Karman, Dr. G. W. Lewis, Mr. Juan Trippe and Dr. E. P. Warner.

British:—Mr. H. E. Wimperis, Professor B. Melvill Jones, Mr. D. R. Pye, Dr. H. J. Gough, Dr. H. Roxbee Cox and Lord Brabazon of Tara.

This England!

TWO 20-year-old Canadian Halifax pilots, both of whom have flown in at least one big Berlin attack, besides a fair number of lesser raids, recently applied for third-party motor cycle insurance.

But they were told that as they were under 21 they would have to get a letter from "a responsible party" before they could be allowed to ride their own motor cycles.

Fortunately, the Dominion lads regard this sort of treatment as a joke.

New A.T.C. Chief

AIR MARSHAL SIR LESLIE GOSSAGE, K.C.B., C.V.O., D.S.O., M.C., has been appointed Chief Commandant and Director-General of the Air Training Corps, and will take up his duties on February 1st, the Corps' third anniversary.

This is a new post which has been created to strengthen still further the close association between the A.T.C. and the R.A.F., as well as to provide the most favourable conditions for post-war development.

Mr. W. W. Wakefield, M.P., who has been Honorary Director of the A.T.C. for the past two years, will retire, and the post of Inspector of the A.T.C. will be discontinued.

The present Inspector is, of course, Air Comdre Chamier, C.B., C.M.G., D.S.O., O.B.E., whose foresight and initiative was mainly responsible for the Corps very existence. He it was who started the Air League, and was the moving spirit behind the pre-war Empire Air Days.

N. Z. Aircrews

AIRCREWS sufficient to fly approximately 2,000 bombers and 1,500 fighters have been sent overseas by New Zealand since the start of the war, it was recently stated by Air Vice-Marshal Isitt, Chief of their Air Staff.

Training had been greatly expanded, and in addition to providing New Zealand-trained flying-boat crews, reconnaissance and attack bomber squadrons, and fighter squadrons for the Pacific war zone, they were also providing technical and maintenance staffs, and were continuing to contribute to the Commonwealth Air Training Plan and to the R.A.F.

Before long they would also add dive-bomber and torpedo-bomber squadrons to the Pacific air operations.

A.L.A.E.

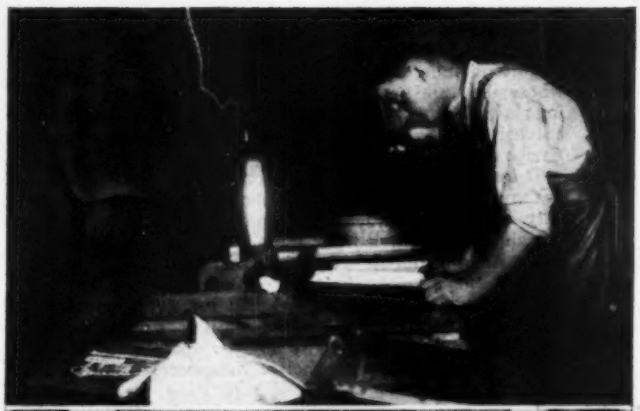
THE above letters stand for the Association of Licensed Aircraft Engineers, which the Royal Aeronautical Society decided to form when it met last week, and passed a resolution to that effect.

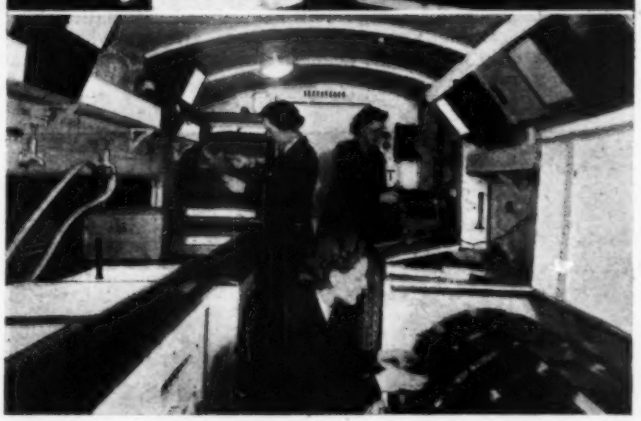
Eleven organisations, besides the R.Ae.S. itself, were represented at the meeting as follows:—Air Service Training, Ltd., Messrs. N. A. Luke, W. J. Andrews, W. W. Gilham and D. Peters; Airwork, Ltd., Messrs. D. Cuthbertson, W. Stapleporter, S. Speight and J. Hopkins; Miles Aircraft, Ltd., W. W. Hall and W. G. Oliver; de Havillands School of Flying, Mr. S. T. Weedon; Air Schools, Ltd., Mr. A. Webb; Short Bros., Mr. H. B. Bexley; B.O.A.C., Mr. J. Noble; G.A.P.A.N. and B.A.L.P.A., Mr. L. W. Wingfield, and the R.Ae.S., Capt. L. Pritchard. The Air Registration Board was also represented.

Of these, Messrs. Luke, Weedon, Andrews, Webb and Gilham were elected to constitute a Foundation Committee to frame a constitution and policy and report back to full general meeting at an early date.

FAIR SAMPLE: This De Havilland Mosquito is probably the only one in existence with U.S.A.A.F. markings. A Canadian-built example of the type, it was handed over to the U.S. so that our Allies could see for themselves (to coin a phrase) "what makes it tick."

Classes in progress at No. 1 School of Photography. The demonstration cameras are of the F24 type.





CONTRASTS: (Top) "J.Y." working in a patched-up B.E. aircraft case in Egypt in 1917. No sinks and no running water. (Bottom) W.A.A.F. photographers processing prints and films in a modern photographic trailer

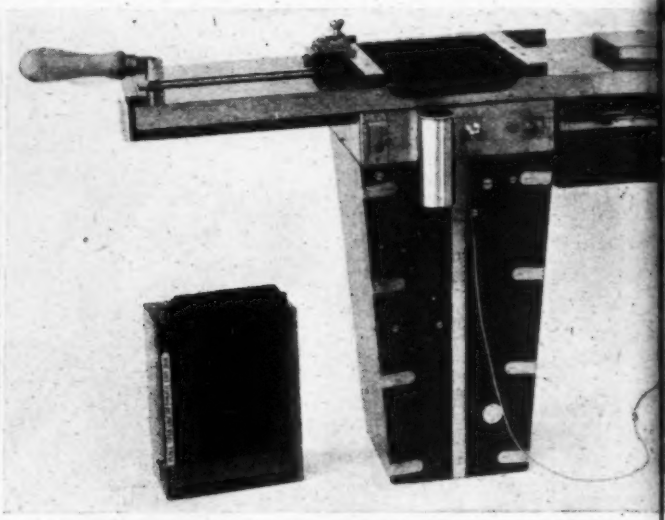
Teaching Air Photography

"Flight" Visits the R.A.F.'s Oldest Photographic Training Establishment

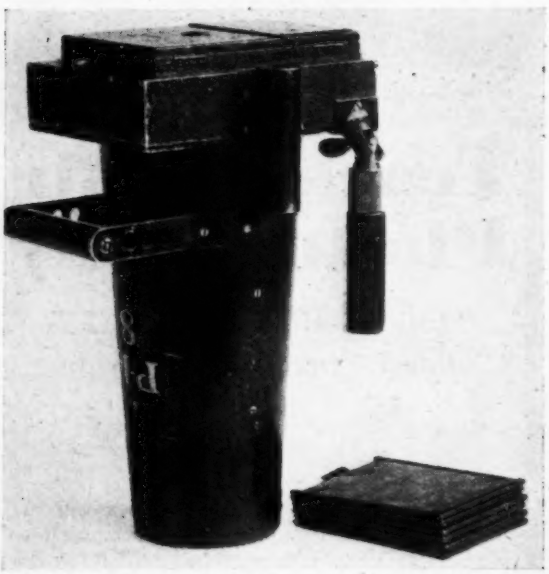
By JOHN YOXALL

CONSIDER just for a moment how little one would know about the war if it were not for the hundreds of photographs which have been published in the Press. These pictures were not, however, taken for amusement or interest but as part of a very thorough intelligence service which reads the enemy's inmost secrets in their details. Our own technicians and tacticians also learn important lessons from operational photographs, and these lessons result in modifications to aircraft—to their armament or to their operational employment.

A photograph automatically taken as a Coastal Command aircraft goes in to make a depth-charge attack on a U-boat may show some change in design or some addition to the deck armament of the German submarine. A length of 16 mm. cine film, run off as a fighter's guns speak in an air combat at 30,000ft. may show a change in enemy air tactics. Damage to enemy war industry is almost entirely assessed from air photographs, and it is only by the continual photography of enemy airfields that their air strength in any particular war area can be estimated. This last is very interesting work because the fall in enemy air strengths over the whole of the



(Top left) The first camera constructed entirely for air photography—the A type of 1915. It took 5in. × 4in. plates in linen slides and was held over the side of the aircraft. (Above) The 1916 C type vertical camera which was clamped to the outside of the fuselage. Plates in magazines of 18 were changed by a hand lever which automatically reset the shutter. Exposures were made by pulling a length of string.

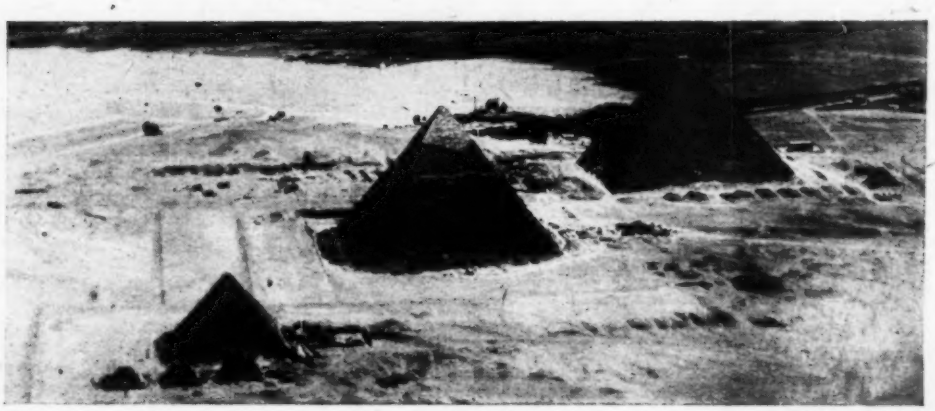


(Above) The P type hand-held camera which came into general use for oblique photography in 1917. It could be fairly easily held in a slipstream of 65 m.p.h.

TEACHING AIR PHOTOGRAPHY

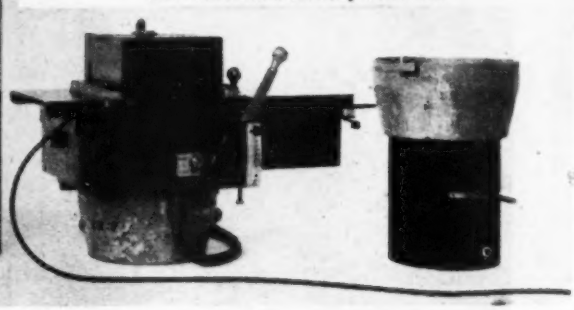
battle areas indicates the degree of success achieved by our heavy bomber policy. Other Service uses of photography include the making of special diagrams in cases where the numbers required do not justify ordinary printing; and portraiture for identification cards. It is also extensively used to illustrate crash reports sent in by engineer officers.

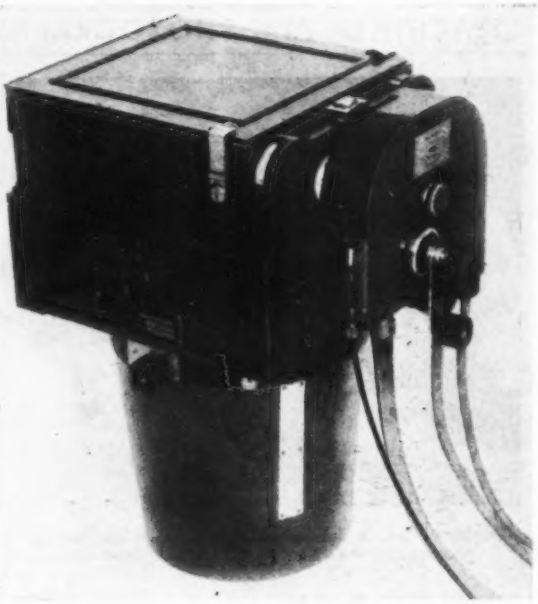
Before describing the work of one of the schools of photography it would be as well to show how the photographic activities of the Royal Air Force are divided. All research work is carried out by scientists at the Royal Aircraft Establishment. Each station has a photographic department of eight to twelve photographers, and each squadron on the station also has its own photographic section. These work together until a squadron moves away. Aircrews are taught how to operate the cameras in the air, and the personnel of the photographic sections are taught all the details of processing, camera-fitting, enlarging and printing, both manual and automatic. The Photographic Reconnaissance Units are somewhat of a law unto themselves, going in, as they do, for things in a big way.



STILL IN THE NEWS. An air view taken with a P type camera in 1917 of the great pyramids in Egypt, where the recent conferences were held. Mena House is just to the right of the peak of the centre pyramid.

(Below) The start of unit construction began with the Williamson L. and L.B. types of 1917. Lens cones of from 4in. focus to 20in. focus on 5in. × 3¼in. plate could be fitted. When the 20in. lens was used it projected beneath the floor of the shallow fuselage of the R.E.8s of those days, and a stay wire was fitted to prevent it from being blown back at an angle. It was mechanically driven by an airscrew and a flexible drive. (Right) The F8 of 1932, which was the first fully automatic and electrically controlled film camera used by the R.A.F. in quantity. Size of picture was 9in. × 7in., and 125 exposures were carried on one roll of film. Height, time and date were automatically recorded.





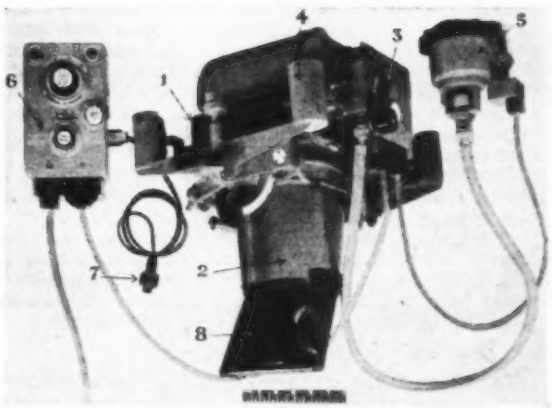
No. 1 School of Photography, an important unit of Technical Training Command which we visited recently, is doing a great job by turning out the hundreds of photographers required to process the innumerable exposures made by pilots and aircrews. It was born in an aircraft packing case on Laffan's Plain in 1915 with a staff of six. Lord Brabazon of Tara (then Major J. T. C. Moore-Brabazon, of the Royal Flying Corps) was the moving spirit in getting the school established. Two other well-known names are connected with the opening of this school —Major F. C. V. Laws, who is now a Group Captain and Deputy-Director of Photography at the Air Ministry, and Wing Cdr. R. R. Burchall, who was then one of the original staff and is now, after a period of retirement, again in charge of the school.

Subjects Taught

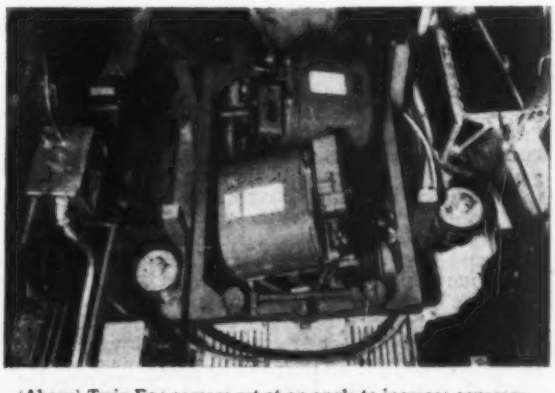
What strikes one most as a tour is made of the classrooms is the businesslike manner in which everything is tackled. This is easily understood when it is remembered that the course lasts only about half the time allowed in peacetime; this despite the fact that the peacetime entries were very largely composed of civil photographers. A recount of the curriculum will show how much knowledge has to be assimilated in a short while. The subjects taken are: (1) Elementary theory (light, optics, chemistry) and use of ground camera; (2) negative-making and elementary printing; (3) working of the F.24 camera; (4) use of air cameras for daylight vertical and oblique photography; (5) film development; (6) advanced printing and enlarging from air negatives; (7) cine camera guns; (8) layout and use of mobile photographic darkroom trailers; (9) night and torpedo cameras; (10) general work to be expected in any average photographic section. This last would include such subjects as stores procedure, section organisation and negative-indexing.

In addition to the foregoing, arms drill and physical training take up quite a proportion of a man's working hours. In these days of paratroops, when the front line as often as not is at the back, every man must know how to use a weapon, and the physical training is stressed for photographic personnel because of the long hours which are spent in the fœtid atmosphere of darkrooms.

At the conclusion of his course the trainee is examined by a trade test board and graded according to his ability —40-60 per cent. marks grade him as an A.C.2, 60-80 per cent. as an A.C.1, and 80-100 per cent. as an L.A.C. Later, after they have gained experience with squadrons, they are regarded by travelling examiners. In peacetime they used to return to the school to take a non-commissioned officer's course, but the travelling examiner system



The modern F24 camera fitted with a 45 deg. mirror attachment. (1) Body; (2) 8in. lens and cone; (3) Gear box; (4) 125 exposure magazine; (5) Driving motor; (6) Control; (7) Operating switch; (8) Mirror attachment for photography during low sorties; (9) Camera mounting.



(Above) Twin F24 camera set at an angle to increase coverage. The Americans use multi-lens cameras for the same purpose. Using short focus lenses enormous areas can be photographed at one time.

TEACHING AIR PHOTOGRAPHY

Pupils of No. 1 School of Photography learning ground photography with Lend/Lease Speed Graphic Cameras.

is found to be more expedient in wartime. There are, however, at the school, refresher and instructor's courses for N.C.O.s. The syllabus covers all aspects of air photography, administration and lecturing, and keeps the N.C.O.s in touch with latest developments. The object of the instructor's course is to teach N.C.O.s how to instruct aircrews on the use of the various cameras and how to impart to them such elementary photographic knowledge as it is necessary for them to know.

Another course at present running at the school is for photographic officers. The trainees are drawn from service photographers of the R.A.F. and W.A.A.F., from photographers with wide civil experience, and from selected officers from the General Duties Branch of the R.A.F., Dominion and Allied Forces. This course, as would be expected, is very comprehensive, with an emphasis on the theoretical rather than the practical.

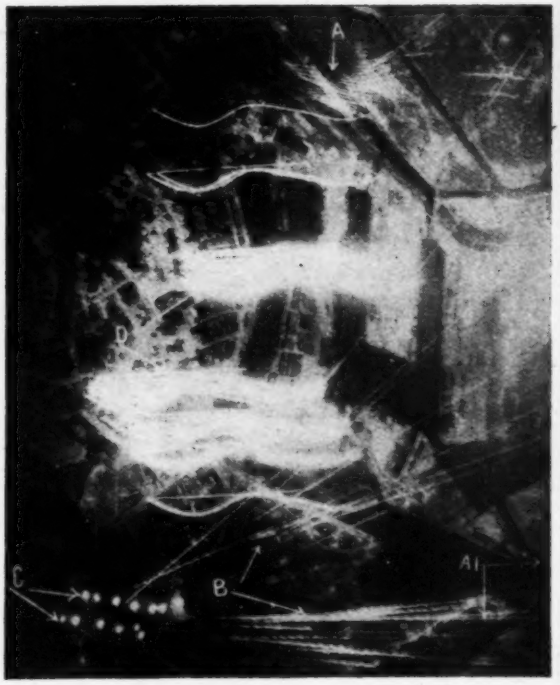
Multi Printing

The wide use made of photography in this war necessitates at times enormous numbers of prints being required off particular air negatives. For instance, imagine the colossal number which must have been distributed before the Dieppe raid or before the invasion of Sicily.

When these large numbers of prints are wanted they are made on automatic multiprinters (one of these was illustrated in our issue of December 2nd, 1943), and No. 1 School of Photography has established a small course for selected N.C.O.s and airmen to specialise in the use of these automatic printers. It is a most fascinating sight to look through the red glass and watch one of these printers at work. The density of each negative is assessed by a photo-electric cell and the correct exposure automatically given. The roll of sensitive paper as it passes through the machine after printing is automatically developed. As each roller is passed, the images become gradually more distinct until they are fully developed and then pass on through a fixing tank. Washing is carried out in a daylight section of the apparatus, and after passing through two pressure rollers, which act as a squeegee to remove the surplus moisture, a heated drum dries the prints and completes the process. 1,500 5×5in. prints can be turned out every hour by one machine.

After a busy day over the Continent a P.R.U. may have thousands of feet of exposures requiring processing. In the film-developing machine a film joiner takes the place of the printing head, but the developing, fixing, washing and drying process is identical with that employed in the printing machines.

Apart from the interest in watching all this vital training in process, there are some interesting sidelights to be seen at the school. Although research work is not done here, they like to keep abreast of the times. Stress has always been laid on three-dimensional or stereoscopic-relief photography in the R.A.F., because it is one of the surest ways of penetrating camouflage. During our visit we were shown some excellent examples of projected stereograms which had been made by polarised light; when these were viewed through polarised spectacles the illusion of relief was staggering. A peculiarity is that if the viewer moves across the room the image appears to turn with him—most disconcerting if the picture is a portrait!



An excellent example of night photography taken by flash bomb over Dunkirk. A and A1 light tracer, heavier flak at B, their point of origin being marked by muzzle flames at C. The tracks of D are caused by incendiary fires. These pictures are taken by opening the shutter immediately before a photoflash bomb previously dropped is due to explode. The flash from the bomb closes the shutter by operating a photo-electric cell.

The school also has an excellent museum of cameras, which includes German as well as our own. The German air cameras are both heavy and complicated, and show little of the German aptitude for camera-making. Seeing the enemy material we asked the question which has been asked so many times—are English lenses really as good as German lenses? The reply was rather surprising. Of Hollywood's lenses, 80 per cent. are English.

In the last war the rear gunner was the air photographer, and if he could thaw his fingers out sufficiently he could—in theory—adjust the speed of the shutter and the aperture of the lens to suit the conditions prevailing over the target. Nowadays it is much more of an exact science. The photographic N.C.O. consults the local meteorological office, who tell him the exact weather which will prevail over the target. The N.C.O. then consults complicated tables and graphs which take account of time, latitude, longitude, height, lens and type of film. From the resulting figure the camera shutter exposures are set, and there is nothing left for the air crew to do but to start up when the target is reached. Although no alteration can be made to the exposure given, the air crew can operate the cameras by hand if the automatic operation breaks down through fault or damage.

RETURN TO "E" LIBRARY

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Production

THE Japanese Cabinet has taken measures to increase aircraft production. These measures are mainly concerned with the financing of a number of auxiliary industries, and supply of raw materials to certain specialised factories.

An Enemy View

COMMENTING on the fighting in Italy, the D.N.B. (the German Official News Agency) military correspondent, Martin Hallensleben, said that Gen. Montgomery is attempting to advance step by step, exploiting his strong air superiority

Civil Transport

THE regular air service between Stuttgart and Lisbon, which was recently limited to three times a week, is now again operating on all week-days.

An air service operating three times a week is to link up Vichy with Sweden. The Swedish Air Transport Company has been permitted to start operations on this route as from December 15th. Aircraft accommodating fifteen passengers is scheduled to be employed on this service.

Comparison

THE Battle of Britain was not nearly as tough for our fighters as the battle of Germany, stated K. Ebert, a German war reporter, over the German radio quoted by Reuter.

Only those who have been in the thick of the battle can tell what it is like fighting these fire-spitting aircraft, which on top of everything else are protected by a strong fighter umbrella.

Only those who have been defending the Reich know what courage is required —even by the most experienced fighters —to disperse the superior enemy formations, let alone to attack them.

Air Commodore Meier, one of Germany's Air Aces, interviewed by Ebert, said: "Nowadays it is the great enemy superiority which increases the difficulties of our fighters. The Focke Wulf 190s have been the most successful in the attacks against these four-engined monsters."

The German Soul—

TO conclude their training at an air war training school *Luftwaffe* officers were addressed by Reichsleiter Rosenberg, the notorious Nazi "philosopher." Apparently to polish up the Nazi convictions of the officers, Rosenberg outlined the ideological problems of our times and reminded his audience of Nazism's claim to world leadership. This claim—he said—is rooted in the great national tradition and the avowed powers of the German soul. . . .

—And the Jap Spirit

WHY Japan would emerge victorious from the rivalry in aircraft production was explained by Lt. Gen. Saburo Endo, head of the Air Armament Department of the Japanese armament ministry in an interview given to the German News Agency. It is the human spirit and willingness to serve, he said, that were decisive.

Endo acknowledged U.S. superiority in aircraft production and raw materials. But even a numerically superior enemy, he said, could be defeated both by the quality of Japanese aircraft and the training, experience and heroism of Japanese pilots.

By way of a more realistic explanation, the Japanese General said that whereas in the U.S. various factories manufactured various types of aircraft, Japan built only those types which had proved their dependability in combat. This limitation made it easier for Japan to change over to the production of new types, an advantage which will offset the numerical superiority at present enjoyed by the U.S.

The Me 323 transport, developed from the Me 321 glider, is powered with six Gnome-Rhône 14N of 950 h.p. each and can carry up to 26,000 lb. of freight or 130 fully equipped men. Named by the Germans the "Gigant" (Giant), the aircraft was employed in the Tunisian campaign and is now widely used to carry fuel and armour-piercing ammunition to the Russian front. Because of the insecurity of rail communications in their rear, the Germans say "it is of decisive importance in the critical situation of the defensive battles on the Eastern front."

Eightieth of the Current Recognition Series

Aircraft Types and

BOEING 314-A (CLIPPER)

AMERICA'S leading example of the transoceanic flying boat, and the biggest in regular passenger mail service before the war, the Boeing 314 Clipper had a crew of 11, including two stewards, and could accommodate 68 day passengers or 36 sleepers. The hull has two decks, the upper one being the control deck and the other the main, or passenger deck. There are also mail and cargo holds with a total capacity of five tons, the aircraft has a complete interphone system and the passenger deck is fitted out with every modern luxury and convenience for long-distance travel.

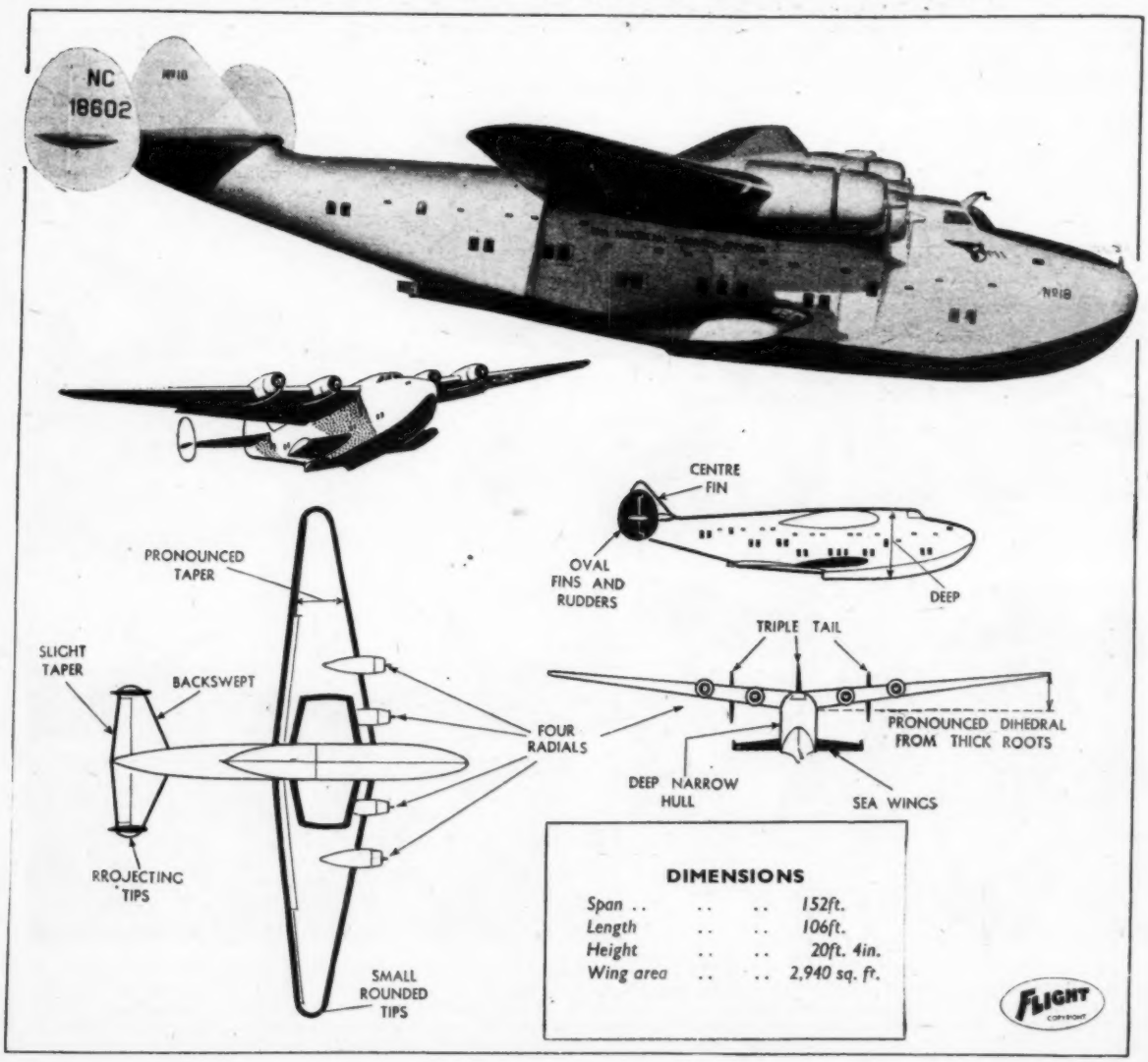
Powered by four 1,600 h.p. Wright double-row 14-cylinder Cyclone engines, the Clipper has a top speed of 210 m.p.h. at 6,200ft., and cruises at 188 m.p.h. on 66½ per cent. of its rated power output at 11,000ft. Its normal cruising range is 3,685 miles.

The structure of its high cantilever wing, which is the same as that of the low-wing Boeing 307 "Stratoliner," is a two-spar design mainly in aluminium alloy with stressed-skin covering.

The hull is a semi-monocoque structure divided into 11 sections by truss-type bulkheads, with a series of watertight compartments below the floor structure and flush riveting on the bottom skin. Cantilever sea-wings, or sponsons (American term "hydro-stabiliser"), are of two-spar construction and also serve as convenient loading platforms.

The wings have an unusual degree of dihedral angle for a high-wing aircraft, and taper sharply on both edges to small rounded tips. They also taper uniformly in section from roots approximately equal in maximum thickness to the diameter of the engine cowlings. The hull, which has two steps, is deep, slab-sided and rounded on top. The tailplane is large, with pronounced backsweep to its leading edge, and carries twin oval fins and rudders slightly inset from the rounded tips, plus a central stabilising fin.

Three Clippers, *Bristol*, *Bangor* and *Berwick*, are in service with B.O.A.C. on transatlantic duties.



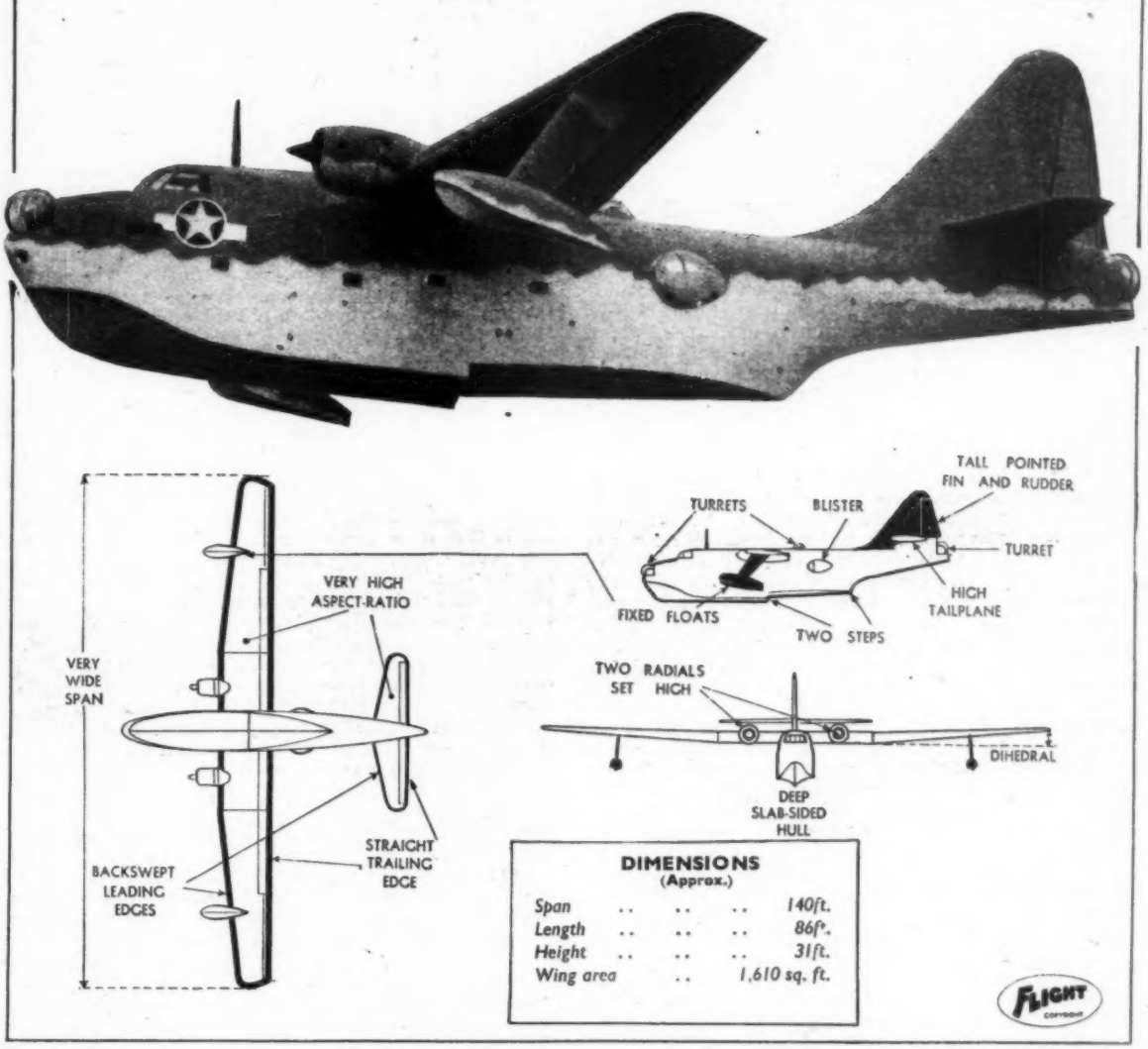
DIMENSIONS

Span	*152ft.*
Length	*106ft.*
Height	*20ft. 4in.*
Wing area	*2,940 sq. ft.*

FLIGHT COPYRIGHT

...nd Their Characteristics

BOEING SEA RANGER



DIMENSIONS
(Approx.)

Span	*140ft.*
Length	*86ft.*
Height	*31ft.*
Wing area ..	*1,610 sq. ft.*

FLIGHT

ALTHOUGH the prototype of the Sea Ranger first flew some 18 months ago, very little information has, as yet, been released for publication.

Powered by a pair of 2,000 h.p. 18-cylinder Wright Duplex Cyclones, the Sea Ranger is the largest two-engined flying boat so far designed, and it incorporates a great deal of valuable experience gained by Boeings in the development of their four-engined Clipper type.

No performance figures, weights, or even dimensions have yet been officially released for the Sea Ranger, but such details as are available indicate that it has a span of round about 140ft. and a length of some 86ft., which is extremely large for a twin-engined aircraft of any type. Loaded weight must be in the neighbourhood of 60,000 lb., and, with the engines fitted a top speed of about 250 m.p.h. can reasonably be expected.

Construction would appear to be on conventional lines, but the very high aspect-ratio of the cantilever high wing, and the distinctive, large area, single fin and rudder will not present any difficulties to the student of recognition. Fixed stabilising floats are mounted well out towards the tips on faired, cantilever struts which are raked forwards. The engines are carried close to the hull on the flat, rectangular centre-section, the outer wing panels are well backswept on their leading edges, but the whole trailing edge is straight; the high tailplane also has a backswept leading edge and straight trailing edge. The deep hull sweeps up sharply aft of the second step to a gun turret in the extreme stern. Nose and dorsal turrets and blisters on each flank are also provided, but the exact nature of the armament they mount is not disclosed. A heavy bomb-load can be carried, together with a number of torpedoes.

Living accommodation, for a crew of ten, is designed for long periods away from base, which suggests that the Sea Ranger has been evolved with a special eye for active service over the wide spaces of the Pacific.

"Indicator" Discusses Topics of the Day

The Female of the Species

The Old Question of Relative Efficiency Still Not Answered : Dissimilar Conditions of Very Initial Training : No More Glamour for the Pilot : The Real Flying Jobs

I SEEM to be embarking on a subject of the utmost danger and difficulty, but so many otherwise intelligent people ask one for an opinion of women pilots that any ignorant remarks of mine can do little harm. In the old days the same people used to ask whether women could drive cars as well as men—in the hope generally that the answer would be comfortingly in the negative, rather than that any useful information would be forthcoming.

My usual answer nowadays is that "I don't know, but women always seem to take medium-sized twins off the ground in a tail-down attitude." Which sounds, I must admit, somewhat Lewis Caroll, but the statement at least permits a further series of remarks to be made, delving into the psychological and other reasons for this state of affairs. At least it is as good an answer as any I've heard, and the fact (if it *is* a fact) may explain many of the subtle differences between the standard of performance of the two sexes in any profession which used to be considered, speaking as a male, to be our own.

Hiding miserably behind a pseudonym, I should say that the primary reasons for this take-off curiosity are lack of confidence, lack of technical knowledge, and, possibly, lack of strength. Maybe they're too busy correcting a series of imaginary swings to find time to get the tail up; or they've found that the thing goes into the sky quite satisfactorily without the necessity for making any further control movements; or they just don't know that they're taking off that way. But whenever I see a Beaufighter or a Mosquito being collected by a ferry pilot in that manner, it's almost a certain bet that the driver is a woman.

Still hiding miserably, I should say that the reason, in the majority of cases, is sheer ignorance. Ignorance not so much of the attitude of the aircraft, as ignorance of aerodynamic principles. If such ignorance cannot be imputed in any particular case, then the driver concerned must be woefully lacking in self-preserving imagination. For a modern aircraft, taken off carelessly in this way, is usually merely wallowing into the air on the strength of one or two reliable engines, and, in a twin, if one so much as coughs as the outfit becomes airborne it will forthwith cartwheel into the ground. Held down on the ground for that extra ten miles an hour, and held down still further so that speed can be obtained as quickly as possible when it *is* in the air, the aircraft will be a totally different affair if one of the engines starts to lose power. Anyhow, a tail-down take-off *looks* untidy, and anything that looks untidy in the air is usually dangerous.

Knowledge or Skill?

All of which is sheer generalisation. Quite obviously there are plenty of clever, technically minded, skilful and thoroughly competent women, just as there are plenty of men with whom I wouldn't trust my motor bathchair. But, in general, women are less interested in technical matters, and are consequently less likely to think them important and to bother to learn about them. Since the modern technique of flying is almost entirely one of the application of knowledge rather than of skill, women are liable to be handicapped until such time as their education from childhood is radically altered.

Except in the matter of day-to-day fitness, there is absolutely no reason why women shouldn't be brought up and trained to do any job just as well as, or better than, a man can do it. They have the same brains, very nearly the same physical strength, and probably more stamina—but, unless they're very tough and determined, their minds are not usually fully occupied with any job other than the one for which they are supposed to be naturally fitted. Nevertheless, any man who holds very strong beliefs of this kind would probably be shocked if he spent an evening with a bunch of female ferry pilots; whereas male pilots talk their particular brand of "shop" for eighty per cent. of the available time, women will talk it for the *whole* of the time, and then some. Of course, they're new to it all, and are very keen both on their job and on the way in which they're doing something never before attempted by the sex. But the proportion of female pilots to the total female sex is a very microscopic one.

Feminine Inferiority

The only real comparative test will come in a world where woman-power is needed as much as man-power, and where each sex is, consequently, given similar opportunities of training and an entirely similar bringing-up. Then we shall see whether there are any real differences in aptitude and skill. I can see no reason why there should be, but in the meantime we live in a world run by men and for men, and whether they're piloting flying machines, driving cars, designing houses or defending criminals, women tend to lack confidence, to show traces of an embarrassing inferiority complex when their men competitors are about, are short of knowledge, and are more temperamental than men. The last is a result of training and environment; there is no reason why a woman rather than a man should excuse her actions on the score of temperament. That is so often merely a useful excuse for bad behaviour generally, or, in the case of work, for bad workmanship, and is a useful let-out if anyone accuses them of running with the hare and hunting with the hounds in the time-honoured manner.

Certainly, the fact that a group of women are doing extremely good work as ferry pilots, and proving themselves at least nearly as good as any man at the job, proves very little. Women have been putting out hot and uncomfortable fires, working in explosives factories, conducting buses, and operating lathes with skill and decision both in this war and the last. There's nothing that any fit and intelligent woman can't do if she so wishes. The women pilots have merely re-proved something already proved by the A.T.A. as a whole since the beginning of this war—that there is nothing much in the business of taking an aircraft off the ground, flying it somewhere, and landing it again.

And a very good thing, too, that this has been shown. For years and years pilots have been shooting their implied lines, and letting all the world think how difficult and dangerous it all was—and along comes a bunch of decrepits, most of them thrown out by the Central Medical Establishment of the Air Force, who take the air in anything from Magisters to Liberators and manage to cope without wrecking them all over the place and without even appearing to find it very terribly difficult. The pilots in the A.T.A. should certainly be a standing example to the Little Man, who always talked about keeping one foot on the ground and went to air displays to watch with a dry mouth and with a faint subconscious hope that there might be a sticky and disturbing incident to complete the entertainment.

The mere business of flying is easy. Practically anybody

THE FEMALE OF THE SPECIES

can be taught to do it, and practically any intelligent and mechanically minded man or woman can be taught to fly advanced modern types without suffering a nervous breakdown or causing the taxpayer a headache in years to come. The difficult parts are those that are rarely mentioned and never explained.

The Atlantic or long-distance transport pilot dealing with navigation, and radio, and weather, and relative ice-forming dangers, while he feathers one airscrew because the engine's oil temperature is rising a little too awkwardly; the bomber pilot who has to find his target and then return seven hundred miles with one and a half ailerons, three engines and no rudder control whatever; the Coastal Command pilots and navigators who take off at night, perhaps, to do a patrol of two hours after reaching an area a thousand miles out to sea, and returning at dusk; the prototype test pilot who, without risking the loss of the aircraft, must find out exactly why and when aileron flutter develops, or exactly what kind of load can be safely taken off from an average runway—and how the aircraft must be handled to obtain the shortest run. That sort of thing is *flying*—the rest is mainly fun and games.

Except that a war lasts rather longer, and people get bored and tired and nervy in the course of it, an ordinary pilot's job is not much more difficult or much less fun than that of a plus-foured amateur engine-driver in the 1926 General Strike. When a ferry pilot, whether male or female, first starts work he or she must feel very like that engine-driver. "Here am I doing, and actually being paid to do, the one job I've coveted since I was forced to go into that appalling insurance office." That sort of thing.

It's very hard work at times, and may even be frightening to the highly strung person; rapid decisions have to be made and troubles diagnosed without fail; new types have to be mastered in the ordinary course of ferrying duties; and destinations have to be found before the light fails in thick weather. All that—but it is still a good job, and most of the ferry pilots will be very sorry if they have to give up flying when this war finally ends. And particularly the female of the species. "INDICATOR."

THE SEVENTEENTH V.C. OF THE R.A.F.

The KING has been graciously pleased to confer the VICTORIA CROSS on Flt. Lt. William Reid, R.A.F.V.R., No. 61 Squadron, in recognition of most conspicuous bravery

ON the night of November 3rd, 1943, Flt. Lt. Reid was pilot and captain of a Lancaster aircraft detailed to attack Düsseldorf.

Shortly after crossing the Dutch coast, the pilot's windscreen was shattered by fire from a Me 110. Owing to a failure in the heating circuit, the rear gunner's hands were too cold for him to open fire immediately or to operate his microphone and so give warning of danger; but after a brief delay he managed to return the Messerschmitt's fire and it was driven off.

Flt. Lt. W. Reid

During the fight with the Messerschmitt, Flt. Lt. Reid was wounded in the head, shoulders and hands. The elevator trimming tabs of the aircraft were damaged and it became difficult to control. The rear turret, too, was badly damaged and the communications system and compasses were put out of action. Flt. Lt. Reid ascertained that his crew were unscathed and, saying nothing about his own injuries, he continued his mission.

Soon afterwards, the Lancaster was attacked by a Focke Wulf 190. This time, the enemy's fire raked the bomber from stem to stern. The rear gunner replied with his only serviceable gun, but the state of his turret made accurate aiming impossible. The navigator was killed and the wireless operator fatally injured. The mid-upper turret was hit and the oxygen system put out of action. Flt. Lt. Reid was again wounded and the flight engineer, though hit in the forearm, supplied him with oxygen from a portable supply.

Flt. Lt. Reid refused to be turned from his objective and Düsseldorf was reached some 50 minutes later. He had memorised his course to the target and had continued in such a normal manner that the bomb-aimer, who was cut off by the failure of the communications system, knew nothing of his captain's injuries or of the casualties to his comrades. Photographs show that, when the bombs were released, the aircraft was right over the centre of the target.

Steering by the pole star and the moon, Flt. Lt. Reid then set course for home. He was growing weak from loss of blood. The emergency oxygen supply had given out. With the windscreen shattered, the cold was intense. He lapsed into semi-consciousness. The flight engineer, with some help from the bomb-aimer, kept the Lancaster in the air despite heavy anti-aircraft fire over the Dutch coast.

The North Sea crossing was accomplished. An airfield was sighted. The captain revived, resumed control and made ready to land. Ground mist partially obscured the runway lights. The captain was also much bothered by blood from his head wound getting into his eyes. But he made a safe landing although one leg of the damaged undercarriage collapsed when the load came on.

Wounded in two attacks, without oxygen, suffering severely from cold, his navigator dead, his wireless operator fatally wounded, his aircraft crippled and defenceless, Flt. Lt. Reid showed superb courage and leadership in penetrating a further 200 miles into enemy territory to attack one of the most strongly defended targets in Germany, every additional mile increasing the hazards of the long and perilous journey home. His tenacity and devotion to duty were beyond praise.

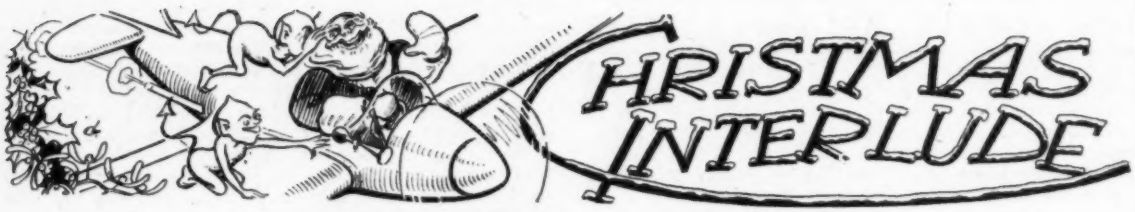
"A.T.C. CALLING"

THE Government's decision to carry on the Air Training Corps after the war was stressed by the Secretary of State for Air, Sir Archibald Sinclair, when he opened the "A.T.C. Calling" exhibition in a West-end store last week.

"Naturally, post-war plans can still only be provisional," he said, "but the long-term nature of A.T.C. training demands that the future of the Corps shall be settled now. The achievements of the A.T.C. in war, and the circumstances likely to exist when hostilities end, have been reviewed, and His Majesty's Government have decided that the Air Training Corps shall continue after the war." Sir Archibald went on to say that war did not exhaust the need for those qualities in our young men which the A.T.C. training developed, and that it would therefore make "a priceless contribution to the well-being of our nation." It would, he added, keep its separate identity under the control of the Air Ministry while co-operating to the fullest possible extent with the other voluntary youth organisations and with the educational authorities.

The exhibition, which remains open for a month at Harrods, Knightsbridge, has been arranged with considerable skill and imagination, and shows, more or less in progressive order, the various facets of training from the early A.T.C. stages right into the advanced airscrew and technical training given after the cadet joins the R.A.F. or F.A.A. Many of the exhibits are, of course, R.A.F. equipment, such as the Link trainer, Synchrophone, Combat Reports, etc. Other interesting exhibits include a Merlin LXI engine, resplendent in its "Earls Court" show finish, a scale model of enemy landscape as used in briefing bomber crews, a working model bomb-rack with its selection and release gear, and the forward section of an ex-operational Lancaster. Model aircraft made by cadets are also on show.

A.T.C. personnel, mainly from London school units, are in attendance to demonstrate the various models and training methods.



Sic Transit

When Father Christmas Flew to Town

By C. B. B-W.

JUST before Christmas in 1938 a certain departmental store decided that Father Christmas should be transported by air from their headquarters store at Nunsford to their branch store at Priorsworth (needless to say these are not the actual place names concerned), and as we had founded a flying club just outside Priorsworth, we were only too glad to undertake the job of collecting and delivering the benevolent old figure.

An elaborate series of proceedings had been devised, whereby Father Christmas was to travel from the head store to the Nunsford Municipal Airport, mounted in state on a huge sled with all the time honoured trappings and a few new ones thrown in to make everything friendly. Our arrangements were to pick him up at the airport and fly him symbolically to Priorsworth where, from the flying field, he would make a triumphant entry into the town. Press photographers were encouraged and hordes of children were bribed and exhorted to make the whole show a noisy, festive success and, quite incidentally of course, a vociferous advertisement for both the store and ourselves.

One of the flying instructors was detailed for the job, and one of the club machines was especially washed and polished for the occasion.

I strolled into the club-house at about 9.15 on the morning of the great day, and the only other person in the place, apart from the steward and the secretary, was Peter the instructor. He was due to push off at 10 o'clock in order to pick up Father Christmas at 10.30, and as Nunsford is only about 38 miles from Priorsworth there was ample time.

We smoked a couple of cigarettes with our coffee, then decided to go down to the hangar and help the ground engineer get out the machine and start it. There were three steps down from the club-house doors and they were very frosty and rather slippery; Peter came down them like a sack of coal, and sprained his ankle effectively enough to prevent his flying for a couple of days.

The only recourse left us was that I instead of Peter should go and collect Father Christmas, so after helping Peter into a chair I picked up my scarf and gloves and took off for Nunsford.

Send-off

My passenger arrived at the airport 20 minutes late owing to some unforeseen hold-up, and the poor old fellow in his whiskers and gay robes was very nearly purple with cold. I procured some coffee for him, and when he had gulped it down we were ready to start. He climbed into the aircraft, the airscrew was swung, and with dozens of kids cheering and sundry cameras clicking, I turned round and taxied out for the take-off.

I asked the old boy if he had ever flown before, and he somewhat shakily replied that he had not, and I gathered that had it not been for fear of losing his job he certainly would not even set foot in "one o' these 'ere things." I assured him that there was nothing whatever to worry about and that the air to-day was very smooth anyway, so he need not feel unhappy about it. He did not appear very comforted.

The aircraft, I must explain, was a side-by-side seat, dual control, cabin monoplane with the control column approximately horizontal and terminating in a wheel; the column sliding in and out of the fascia panel for elevator control with the wheel providing aileron control in the conventional manner.

We took off, and I climbed to about 1,200 feet. Father Christmas seemed absorbed in seeing the familiar landscape from an unfamiliar viewpoint, and, I was glad to see, did not appear to be at all jittery on his first flight. I felt, somewhat prematurely, relieved.

We had been airborne for about ten minutes and were about half-way back; I was looking out through my side window when suddenly the wheel went forward in my hands and the aircraft at once started going down pretty rapidly. I hauled back the column and shouted at my passenger.

Transition

Apparently he was not feeling too sprightly and had just put both hands on the wheel in front of him and rested his troubled head on his wrists. Of course, the resultant dive and the correction had made him feel worse than ever, and all he did was to grip the wheel even harder. I reached across his bowed shoulders and opened his window, shouting into his ear that if he wanted to be ill to shove his head out and let go.

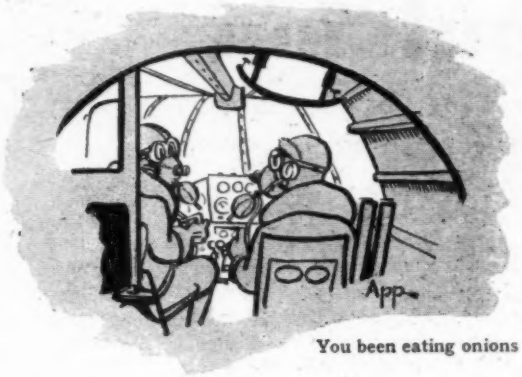
The struggle I was having with the control column against his desperate clutching was making the aircraft lurch about the sky in a beastly manner, and it only aggravated the poor old fellow's already tortured inside. Unfortunately, he did NOT make use of the opened window!

We landed at Priorsworth without any aerial flourish of trumpets, and instead of taxying over to the club-house I made straight for the hangar. The manager of the Priorsworth branch of the store came scurrying anxiously along, closely followed by a director of the club and a couple of inquisitive photographers. When the store manager saw the state into which his Father Christmas had fallen he nearly burst into tears.

The unsavoury robes and trappings were stripped from the unhappy person, and the store manager borrowed the director's car and hared off to his shop to get a new costume. We took the poor old blighter into the club-house for a wash and brush-up, fed him a fairly stiff whisky and led him back to the hangar, by which time the manager had reappeared with a new costume which was hurriedly draped on the aged victim.

Another (clean) machine was wheeled out and taxied up to the club-house, a spick-and-span (but still rather shaky) Father Christmas climbed in beside me, and then climbed out again to the accompaniment of clicking camera-shutters and much hearty yelling from the assembled children.

The last we saw of Father Christmas was a vermilion blob mounted on a huge model sleigh being towed by a score of happy school-kids whose noisy merriment was wafted back to us on the cold breeze.



You been eating onions ?

Invitation

"Ah, what is home without a mother!" observed the P/O. over the 'phone to his girl friend.

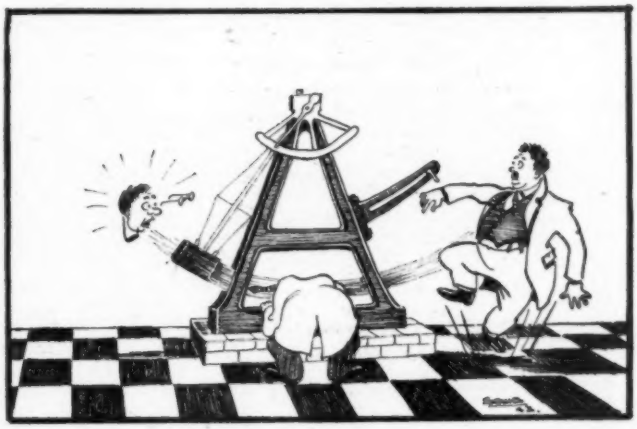
"I am, to-night!" she murmured coyly.

Shooting a (Railway) Line

A certain intruder pilot had, as pets, a couple of dachshund puppies.

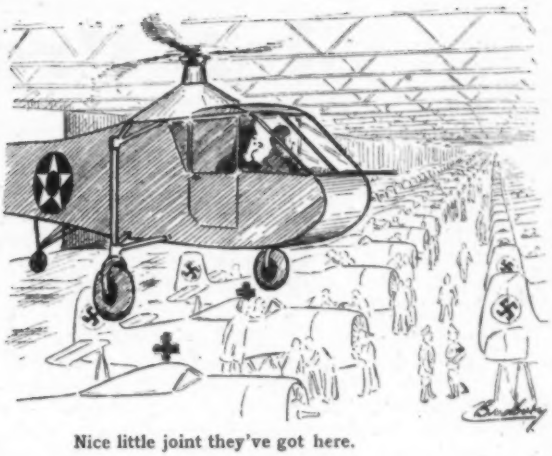
"Where did you get them?" asked a friend.

"Oh, I grabbed them out of some kennels I passed when on a train-busting job," grinned the pilot.



Hi !

Good heavens, girl ! Holes equally spaced doesn't mean all over.



Nice little joint they've got here.

Flying.

Give him a little backstick, we're nosing over.

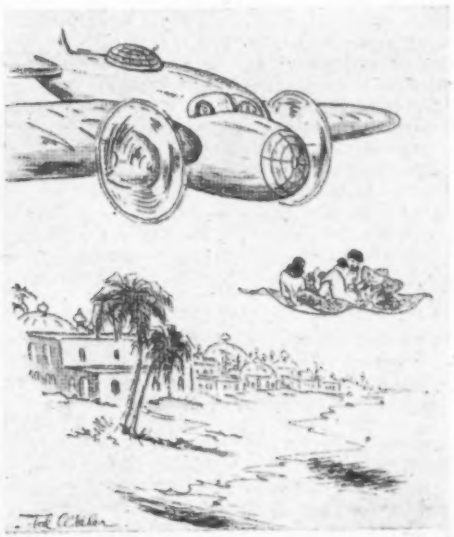
Not so Dumb

Sgt. (to A/C.2): "Now then, take that opinion off your face!"

Home Comforts

Wing Cdr.: "Did you enjoy your leave?"

Station Adj.: "Oh yes, thanks, but there's nothing like having a good desk under your feet."



Flying.

There's that guy who's always coming back from his furloughs with those wild stories.

Jet Propulsion

A Swiss Expert on the Development of Jet and Rocket Power Plants : The Superiority of Liquid Fuel

READERS who enjoyed the article by Mr. J. J. Smith entitled "Rocket Research," published in our issue of December 2nd, 1943, will be interested in the following notes by a Swiss author, Herr J. Stemmer, dealing with the question of the development of jet or rocket propulsion as applied to aircraft. The article was originally published in the Swiss journal "Flugwehr und Technik" of July-August, 1941, and has been translated by V. P. Akimoff for R.T.P. of the Ministry of Aircraft Production.

The original article devoted a good deal of space to the laws of jet propulsion, but as the mathematics might prove somewhat embarrassing to many of our readers they have been omitted here, and we reproduce only that part of the article which deals with general principles and with the results of certain experiments. Those who wish may read the mathematics in the December issue of the Journal of the R.Ae.S. It is worth noting in passing that while Mr. J. J. Smith and his associates made their rocket experiments in the "Misty North" from 1934 to 1939, Herr Stemmer began his researches in 1936. Our series of articles on the subject, by Mr. G. Geoffrey Smith, appeared during August, September and October of 1941.

THE following considerations deal with the mode of operation of a jet-power plant using liquid fuel, and indicate its great advantages over the powder rocket, especially from the point of view of the main requirement of high outflow velocities.

When the powder charge of a rocket is ignited it burns until nothing more remains of it. One of the main drawbacks of this method is the impossibility of mechanically controlling the combustion, i.e., of regulating the propulsive force which is a principal requirement in modern engine design.

Let us now examine the further performance possibilities of the powder rocket. In general, the jet engine performance is given not in h.p. but in kg. of thrust, since the underlying principle is that of action and reaction. A force is required to expel the gas out of the cylinder; this force is represented by the gas pressure, which is measured in kg./cm.². The thrust is equal to the momentum of the cylinder, which is propelled in the opposite direction. The cylinder may be prevented from moving, which enables us to measure the reactive force with a dynamometer.

In life-saving and hail-dispelling rockets, the rockets have a discharge nozzle for the escaping gases, by suitable modification of which we can considerably increase the outflow velocity. In modern firework rockets the nozzle is represented by a short constriction in the passage; in these rockets the outflow velocity is from about 400 to 600 m./sec. The powder rocket was intensively studied by Goddard, who investigated the properties of various types of powder, with special reference to the nozzle problem. The following table gives the optimum values obtained from a long series of tests:—

	Outflow velocity in m/sec.
Ordinary powder used for the Coston-Schip rocket	1,600
Pistol powder No. 3 of the Dupont Powder Co.	2,290
Smokeless "Infallible" powder	2,434

According to Goddard, the most effective nozzles are long conical apertures, of the type of the Laval turbine nozzles. The outflow velocities obtained with them are, however, low in comparison with those obtainable with jet-engines working on liquid fuel; in addition, work with powder rockets is not always safe, and efficient presses of several tons power are required to compress the powder charges.

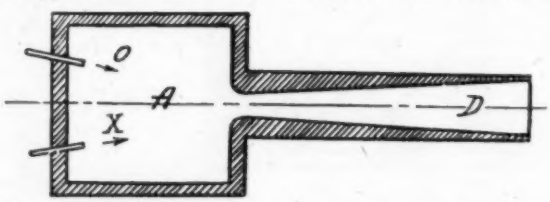


Fig. 1. Principle of the jet. A is the combustion chamber, D the nozzle, X and O the feed pipes for fuel and oxygen respectively.

From all these drawbacks, it is obvious that the powder rocket cannot be taken into serious consideration for the solution of the jet-propulsion problem. The present endeavour, therefore, is directed to designing a controllable rocket engine which will be as reliable in action as an ordinary internal combustion engine.

The possibility of mechanically regulating the fuel supply enables us to vary widely the performance under all conditions.

Fuel Injection and Atomisation

Such an engine is represented diagrammatically in Fig. 1. It consists of a combustion chamber with a conical nozzle for the expansion of the gases. The fuel, e.g., petrol, alcohol or hydrogen, is introduced through one feed pipe, and the oxygen required for combustion through the other pipe; ignition may be effected electrically. As in the modern internal combustion engine, considerable importance is attached here to the method of fuel injection and atomisation. But a detailed discussion of all the various factors would be beyond the scope of this article. The purpose of the nozzle is to enable complete expansion of the combustion gases escaping at high velocity; this velocity is of decisive importance and constitutes the essential point of the whole problem. It depends on the pressure ratio, the specific heat ratio and absolute temperature, as well as on the gas constants. The reader specially interested in these questions is referred to the relevant literature on thermodynamics (e.g., Schüle's Thermodynamics).

The fuel mixture also plays an important part. Here, again, the conditions governing the admixture of air or pure oxygen are essentially different from those in the ordinary internal combustion engine. However simple the external design of the jet engine, the internal combustion and gas-escape phenomena involved are all the more complicated.

Another point of interest in this connection is the question of efficiency which, indeed, is the best criterion by which we may form an opinion of the new engine. Closer study of this problem shows that the efficiency factor can be defined in various ways.

The question of efficiency was studied in detail by Dr. Sänger in his book (*cf.* bibliography).

The problem can best be visualised by comparing the jet-engine with the standard petrol engine. Like the latter, including the whole transmission gear, but excluding the

JET PROPULSION

airscrew, the jet-engine may also be assumed to have "internal efficiency." This arises from the practical imperfections of the plant, and is represented by the ratio of the energy obtained from the engine to the thermal energy of the fuel used. The fact that to-day the maximum internal efficiency obtainable from the internal combustion engine is only 30 to 35 per cent. is due to the following inherent faults:—

	Fuel energy.
1. Chemical losses due to incomplete combustion owing to bad mixing and lack of oxygen	about 5 per cent.
2. Losses of fuel caused by scavenging with fresh gases	—
3. Losses due to the time required for combustion which is not limited to the dead centre of the crank	—
4. Losses of heat due to the walls	about 15 per cent.
5. Losses due to leakage in the piston	—
6. Gas flow losses due to leakage of pipes, mixing nozzles, pumps, etc.	about 5 per cent.
7. Frictional losses in the whole transmission gear	about 15 per cent.
8. Exhaust losses through incomplete combustion and cooling of the exhaust gases	about 30 per cent.
Total losses	about 70 per cent.

The well-known efficiency factor $\eta = 0.30$ to 0.35 per cent. of the internal combustion engine is based on the above table.

In the light of the investigations so far made, these losses in the jet-engine may be summarised as follows:—

The losses No. 1 are of approximately the same magnitude as above.

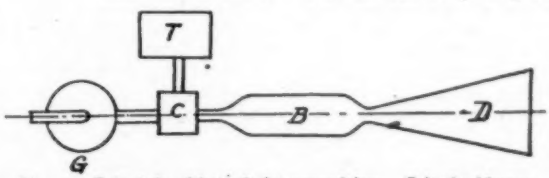


Fig. 2. Principle of hot-air jet propulsion. G is the blower, T the fuel container, C the mixing and carburation chamber, B the combustion chamber, and D the expansion nozzle.

Losses Nos. 2, 3, 4 and 5 do not occur at all since, as we have seen, the jet-engine has no pistons, and the heat given out to the walls is used for pre-heating the fuel.

Loss No. 6 may be assessed at about 3 per cent.

Loss No. 7 is also completely eliminated by the construction.

The losses No. 8 are just as essentially important in the jet-engine as in the internal combustion engine. We can, however, in a large measure control directly the combustion, and the expansion and terminal temperatures are but a question of the length of nozzle, which also can be varied within wide limits. (In full-size engines these losses will be less than in the tests which have so far been made on experimental models.) According to the author's own measurements the total of losses No. 8 may be estimated at 10 to 15 per cent.

High Internal Efficiency

There are no further loss factors in the jet-engine, so that the total loss in it may be put as 18 to 23 per cent., the mean value of η becoming 80 per cent.

Sänger defines internal efficiency graphically as the square of the ratio of the actual discharge velocity of the combustion gases to the theoretical. This value, therefore, represents a fixed valuation standard.

Using a mixture of 1 part, in volume, of hydrogen with 2 parts of oxygen, with a calorific power of 1.03×10^6 kgm./kg., Professor Oberth obtained a theoretical gas discharge velocity of 4,470 m./sec., and actually measured 4,000 m./sec., which corresponds to an efficiency of 80.3 per cent., as described above.

Conditions are very different in the case of the so-called *external efficiency* of the jet-engine in flight. Kinetic energy and efficiency in actual flight are determined by the speeds attained. This point is also represented very clearly by Sänger, who introduces the ratio of transport work to engine work as a so-called transport efficiency.

In the flying jet-propelled engine this factor is very variable, but not in the ordinary aircraft which has a more or less constant cruising speed lacking in the former. Consequently, we can only speak, to a certain extent, of a momentary efficiency, corresponding to the flight condition which is being considered.

At lower flying speeds this factor is very small (2 to 4 per cent., as against 20 per cent. with the ordinary aircraft), but its value increases very considerably at supersonic velocities in empty space, where it may reach as much as 50 per cent. This figure includes the effects of the unfavourable conditions in climbing through the atmosphere, and also of the conditions of acceleration imposed by physiological considerations.

These external relationships depend to a very great extent on the nature of the climbing path of this type of jet-propelled aircraft. It follows from this, further, that jet-propelled flight in the atmosphere would be just as uneconomical as, for instance, rocket propulsion of land vehicles. But the above considerations on the working conditions of the rocket in flight also have their weak point, in that they do not take into account the considerable run out or gliding stretches which will form by far the greatest portion of the whole trajectory in practice. Of decisive importance in the matter may well be the very great economy in time and fuel which jet-propelled aircraft will enable us to realise.

The fact that so little progress has hitherto been made in the solution of this problem is chiefly due, in the first place, to the rather impracticable way in which the realisation of the jet-engine was attempted and, secondly, to the difficulties of construction which were encountered from the first trials, mainly owing to the combustion temperatures.

Researches on the Jet-propelled Engine

In his book "Die Rakete zu den Planetenräumen" (By rocket to inter-planetary space), Oberth was the first to suggest the use of liquid fuel with jet-engines. The whole problem is dealt with on strictly scientific lines in this work, which gave inspiration to Max Valier, the great Austrian supporter of the jet-engine, to start his researches It was he who, in collaboration with the automobile manufacturer Otto von Opel, carried out in 1928 the first public trials with a rocket-propelled car.

The largest car built by von Opel attained a maximum speed of 236 km./h. on May 23rd, 1928, on the Avus Course, near Berlin. It was driven by 24 Sander powder rockets, 12 cm. in diameter and 80 cm. long. To prevent the front part of the car from rising during the run (it was very light in weight, owing to the absence of the petrol engine), short wings with a strong negative setting were attached to the sides.

After this, a second car was built to run on rails, but was wrecked during the trials owing to the high speed reached. Finally, Opel risked making personally a flight in a converted sailplane propelled by powder rockets.

This aircraft covered a distance of 1,400 m. at a maximum speed of 140 km./h. and was also wrecked during the trial flights.

Since Opel treated the whole matter as an advertisement for his firm, Valier broke off his connection with him, and built his own experimental car, in which liquid fuel was used for the first time. Valier developed a total of seven different cars, with which he obtained valuable practical information about his new engine. The purpose of this

research was not the development of a new motor car, but that of the engine itself.

During that same period (up to 1933), the engineer Tilling, of Osnabrück, was experimenting with the so-called powder rocket torpedoes. These rockets reached heights up to 5,000 m. Landing was effected by means of a parachute or wings which opened out automatically on reaching the ceiling. In climbing, the parachute or wings were folded into the stabilising fins.

Tilling, too, was killed while experimenting in his laboratory.

The Italian Experiments

During 1940-41 reports were received of successful trials in Italy of a jet-propelled aircraft. The motive power was reaction, and was termed hot-air jet-propulsion. The oxygen required for the combustion of the fuel (petrol) was obtained from the air; this, obviously, had the advantage of enabling larger fuel supplies to be carried. The principle underlying this type of propulsion may be gathered from Fig. 2.

The engine was designed in 1932 by the Italian Campini, who took out a patent for it. The relative wind is passed through a honeycomb scoop fitted around the fuselage, into a centrifugal compressor driven by an engine or gas turbine. From the compressor the air stream is steadied by passing through the engine radiator, from which it finally reaches the combustion chamber where it is mixed with the fuel and burnt in an annular space (Venturi tube). The combustion gases are expelled through a nozzle of the same type as that used in other jet-engines.

The aircraft built by the Caproni Works corresponds to this design, except that an ordinary airscrew is used for taking off. In flight the engine works the blower which compresses and heats the induced air.

Personal Investigations

Up to that time the author's personal researches had been exclusively directed towards developing an engine for liquid fuels. For this purpose a test engine was built, with which a first series of experiments were made in 1936. The cylinders of a two-cylinder Mercedes motor car engine were used as the combustion chambers, after suitable modification to incorporate required intake system and expansion nozzles.

The engine was then used for the following investigations:—

Measurement of the reactive force.
Measurement of the discharge velocity of the combustion gases.
Thermal conditions.
Fuel injection and atomisation.
Fuel mixtures.
Various types of expansion nozzle.

The reactive force was measured by the simple method of mounting the whole engine, including the pressure bottles and tanks, on a ball-bearing carriage coupled to a dynamometer fixed on the bench. At the beginning of the tests considerable difficulties were encountered, due to the high temperatures produced, which caused parts of the nozzle and injection system to melt. Cooling was mainly effected by means of a cooling jacket on the cylinder. The fuel itself was mostly used as the internal cooling medium, water being used for this purpose only occasionally.

The fuel mixtures tested were petrol-air, petrol-oxygen, alcohol-oxygen, acetylene-oxygen and hydrogen-oxygen.

With the exception of acetylene and hydrogen, all fuels were injected in the liquid state. In many of the tests the oxygen was also injected.

All these experiments involved a great wastage of time because of the modest and rather primitive testing apparatus available. Parallel with these test bench researches a first series of flight trials was made with a model, the engine of which had been designed from the experience gained. The last flights were made in April, 1941, at Katzensee, near Zurich, and a speed of 193 km./h. was reached. The aircraft model used was provided with a distant control mechanism, a maximum distance of 3.8 km. being actually covered. These test flights were not intended to reach great altitude, and were kept to the horizontal at a maximum height of 50 m. Owing to an error of steering and the failure of the aerial, one landing was made on a mud bank, but two other landings were successfully effected on the water. Very little attention was paid to the aerodynamic properties of this aircraft model.

A larger scale model, with a span of 4.8 m., now being constructed, also designed for alighting on water, should have better flying properties; it is intended exclusively for demonstration purposes. At first it was provided with three small jet-engines, of which the two outer (accommodated in the nacelles) were to be used for steering. Experience during the last flights with the old model indicated, however, that this would involve fairly considerable difficulties. Consequently the two outer engines were removed and replaced by ordinary control members; the jet-engine is now situated in the middle fuselage. The fuel and oxygen tanks are in the floats, and the controls in the wing centre section. As a further development it is intended to build a so-called long-range rocket, which should have a range of about 100 to 150 km.

Conclusions

Close study of the principle of the mass ratio outlined above will have shown that the fuel consumption of this type of engine is very heavy, and that, therefore, the engine will not be able to work for hours on end in flight (the first aircraft model consumed 38 gm. per second). But owing to the large power of the engine the terminal velocity which can be attained in a short time is the decisive factor. The flight of such an apparatus is also fundamentally different from that of an ordinary aircraft. From the take-off, care must be taken that acceleration (i.e., speed increment per unit time) is not excessive, since it is acceleration, and not velocity, which has harmful effects on the human organism. The combustion gases escape with a velocity of 3 to 5 km./sec., which will also be the speed of the aircraft. But, in the case of the jet-engine, we can regulate the inflow of the fuel, and thus reduce the acceleration to a bearable amount. A man of normal build can easily stand an acceleration of as much as 30 m./sec.^{2}, i.e., the aircraft will be able to cover a distance of 30 m. in the first second, 60 m. in the second, 90 m. in the third, and so on. At the end of the first minute the speed will, therefore, be 1,800 m./sec. = 6,480 km./h.

Now in long-distance flights, e.g., from Europe to America, the engine need not work during the whole flight, but for a very short time. The take-off thus resembles that of a projectile leaving a gun.

At the end of two to five minutes an aircraft equipped with a jet-engine will have attained a very high terminal velocity. This velocity will be at its maximum at the instant when the engine is cut off. The trajectory begins by rising steeply. When the engine is cut off the velocity starts to drop at a constant rate owing to the effect of gravity, and also, at first, to the resistance of the air, with the result that the trajectory becomes flatter. The velocity developed should be sufficient, however, to bring the aircraft to a high altitude, e.g., from 500 to 1,000 km., whilst the engine is only required to run up to a height of 50 to 100 km. On reaching the apex, the aircraft is put into a glide. (The term "glide" is not quite correct, since the flight path is still stabilised by the kinetic energy.) In any case, the trajectory will not be steep and, consequently, the velocity will not be zero at the apex. The actual glide will begin only in the highest air strata, i.e., at an altitude of about 100 km.

Calculation shows that the time required to fly in such an aircraft from Europe to America will be from 30 minutes to 2 hours (depending on the acceleration adopted).

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The Miles "X"

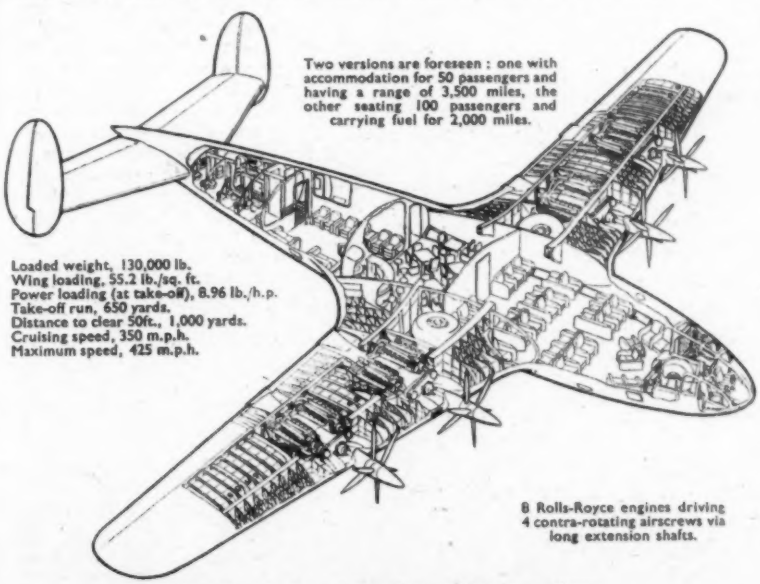
Clean Design Results in Ranges of 3,450 Miles and Cruising Speeds in the Neighbourhood of 350 m.p.h.

The Miles "X" seen from below.

OPINIONS differ greatly concerning the shape of post-war commercial aircraft; not those of the immediate post-war period, but the rather more distant types which will result from long-term planning. Mr. Roy Chadwick, Avro's chief designer, expressed the view the other day that for the next ten years aircraft will be of fairly orthodox type. Sir Frederick Handley Page did not agree. New tools were needed for shaping the new world, and it might be that we should go on building aircraft of the general type used to-day, but he doubted that anyone would buy them! Some think the tailless all-wing type will be the ultimate solution, at any rate for very large aircraft. Then there is the basic dispute as to the merits of the flying boat versus those of the landplane. In all this there is material for quite a number of large "headaches."

Rarely in the history of human endeavour has a completely revolutionary idea or change proved ready and able to spring into full and satisfactory service. The real successes have, with few exceptions, come from step-by-step evolution, and so it may well prove in the case of aircraft. Much may still be achieved by careful attention to aerodynamic design without departing from the accepted and proved general layout comprising wing (with engines), fuselage and tail. An early and somewhat abortive attempt to smooth the path for the air was made a great many years ago by Westlands, when they built the Voyevodski monoplane. The machine crashed when taking off, and work on its development was abandoned. But aerodynamic science has been placed on a firmer footing since those days; high-speed wing sections have been developed, interference effects are better understood, and means have been found for reducing engine cooling drag.

By way of an example of what might be done along such lines we publish the following notes on the Miles "X" type, a design which sets out, in the words of Mr. F. G. Miles, "to have a performance higher than anything yet attained and to be representative of the highest degree of aerodynamic efficiency attainable in the light of present-day knowledge."


Two versions are foreseen: one with accommodation for 50 passengers and having a range of 3,500 miles, the other seating 100 passengers and carrying fuel for 2,000 miles.
Loaded weight, 130,000 lb.
Wing loading, 55.2 lb./sq. ft.
Power loading (at take-off), 8.96 lb./h.p.
Take-off run, 650 yards.
Distance to clear 50ft., 1,000 yards.
Cruising speed, 350 m.p.h.
Maximum speed, 425 m.p.h.
8 Rolls-Royce engines driving 4 contra-rotating airscrews via long extension shafts.

A sectioned view of the Miles "X" from above.

Although the design appears sufficiently startling in this year of 1943, it should be pointed out that the original design was first published in *Flight* of April 21st and 28th, 1938, or, in other words, nearly six years ago. That design, known at the time as the "X.2" transport, was of comparatively modest dimensions: span, 99ft.; wing area, 1,762 sq. ft.; loaded weight, 61,000 lb.; wing loading, 35 lb./sq. ft. It had four engines "buried" in the wing and driving the airscrews through extension shafts.

That the 1943 version is more ambitious is shown by the corresponding figures, which are: span, 150ft.; wing area, 2,350 sq. ft.; loaded weight, 130,000 lb.; wing loading at take-off, 55.2 lb./sq. ft.

The general layout of the "X.2" was actually completed in 1936, so that it cannot be denied that the Phillips and Powis designers (the name since changed to Miles Aircraft, Ltd.) were well abreast, not to say ahead, of the times. Since those days Mr. Miles has been able to do a con-

THE MILES "X"

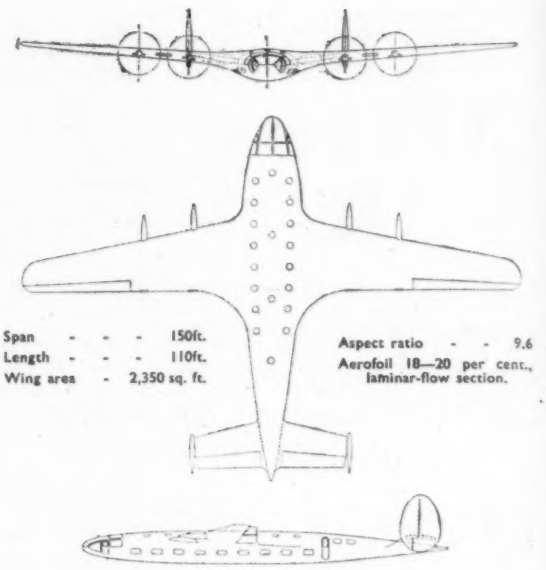
siderable amount of research. Not only have wind-tunnel tests been made, but actually a flying scale model has been built and flown. This model, built to a scale of one-third full size, gave full confirmation of the theories underlying the design and provided many valuable data. Here it may be of interest to mention that the model had a span of 50ft.; a wing area of 261 sq. ft.; an all-up weight of 4,800 lb.; and a wing loading of 18.5 lb./sq. ft. The power was provided by four Lycoming engines of 125 h.p. each.

An essential feature of the Miles "X" is the manner in which the fuselage merges into the wing. Interference between wing and fuselage is thereby reduced, but apart from this aerodynamic drag advantage the cross-section affords a very large space for passenger and/or freight accommodation. By way of an illustration it may be mentioned that the cabin volume is 6,000 cu. ft. The spars of the centre-section are made in the form of a stressed ring having the same shape as the fuselage cross section in that plane of the aircraft. In that way an unobstructed cabin is achieved.

Eight "Buried" Engines

Another feature of the design is the use of eight engines, buried in the wing, which drive four contra-rotating airscrews. The design is based on Rolls-Royce engines of an assumed total T.H.P. of 14,000 at 425 m.p.h. and 16,000ft., and of total maximum weak-mixture continuous T.H.P. of 10,000 at 380 m.p.h. and 18,000ft. Contra-rotation is obtained by the engines of a pair driving one airscrew each, long shafts in streamlined casings projecting well ahead of the wing Apart from the gain in aerodynamic efficiency thus attained, there is the very practical advantage that the view from the pilots' compartment is particularly unrestricted, the shaft casings being of much smaller area than the usual engine nacelles, while the sweep-back of the wing and the long fuselage nose in any case place the pilots well forward of the airscrews.

In an aircraft of this size flight engineers would be carried, and consequently the number of controls and instruments in the pilots' compartment has been reduced to a minimum. In addition to their ordinary flying controls and trimming tabs, the pilots have only two throttles and the flap control. The flight engineers are in charge of engine and fuel controls, instruments and undercarriage control. Pilots' instruments have been limited to the normal blind-flying panel, the beam-approach instruments, two compasses and an outside air thermometer.

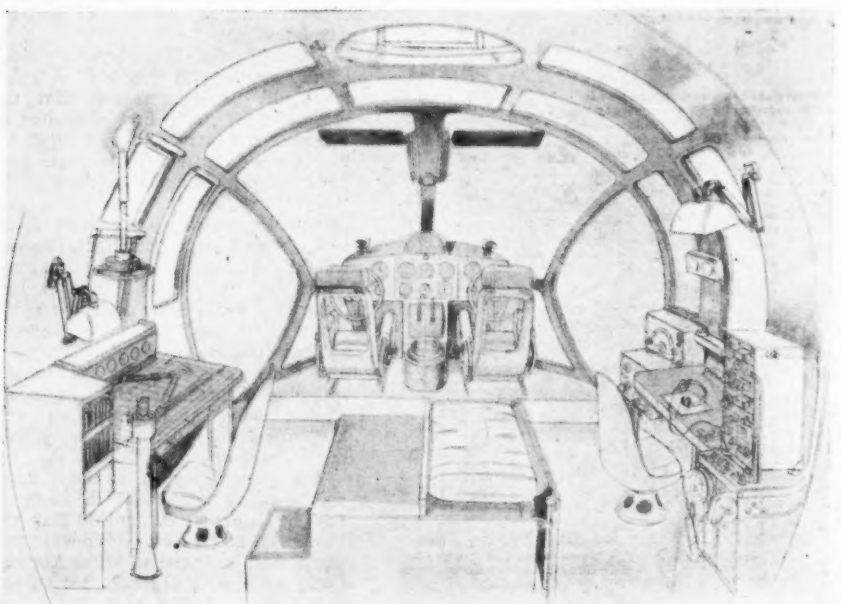


The main undercarriage is, of course, retractable, but a nosewheel is optional. If desired, a pressure cabin can be provided at the expense of a certain amount of pay load.

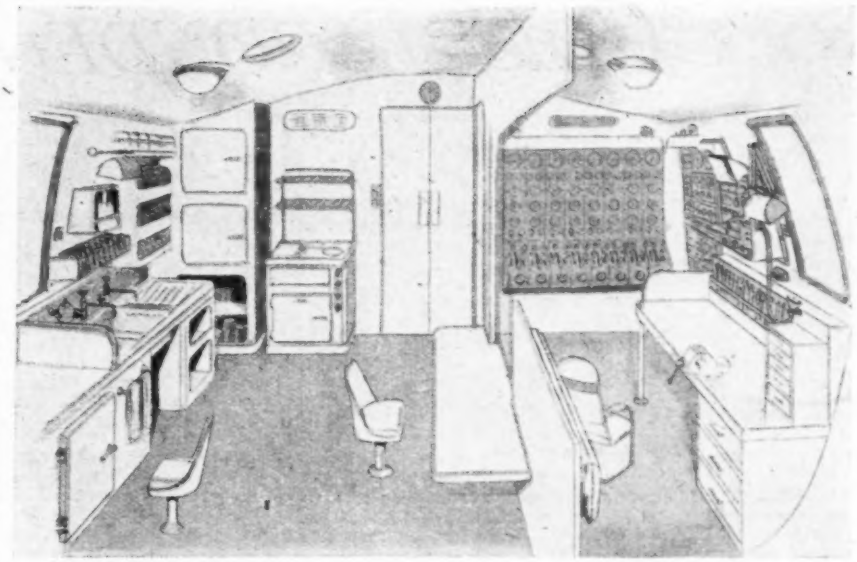
Although the Miles "X" could obviously be equipped as a bomber, it is with the possible civil uses that we prefer to deal. Three versions have been foreseen, although only the first two are of real interest. The three are: a long-range version (3,450 miles range); medium-range version (range 2,000 to 2,500 miles); short-range version (range 1,100 miles). The short-range version is scarcely attractive for commercial operation, the fundamental basis of the design being so obviously aimed at fairly long ranges, but one may imagine uses to which it could be put for war transport. However, that possibility is now remote.

Estimated empty weight of the other two versions is 65,000 lb. For the long-range version there will be relatively few passengers, viz., 50, and the weight of cabin furnishings, equipment, etc., for them is estimated at 5,000 lb. Radio, automatic pilot and similar items are estimated to require 1,000 lb., while the crew of five will account for 900 lb. This adds up to a tare weight, equipped, of 71,900 lb. At the estimated all-up weight of 130,000 lb., that leaves 58,100 lb. for disposable load. This might be made up as follows: 50 passengers, 8,500 lb.; luggage, 2,750 lb.; fuel (5,930 gals.), 42,620 lb.; oil (470 gals.), 4,230 lb.

On the assumptions as to T.H.P. available from the



A pencil sketch of the interior of the pilots' cockpit. The navigator is on the left and the wireless operator on the right.



The flight engineer's station and the chef's galley.

eight engines, the maximum speed will be 425 m.p.h. at 16,000ft., according to drag estimates made from wind tunnel and flying scale model results. The same results indicate a range of 3,450 miles against a headwind averaging 50 m.p.h., cruising at 350 m.p.h. at 7,000ft. Calculations indicate an initial rate of climb of 1,500ft./min. and the surprisingly short take-off run of 650 yards. This appears optimistic for a wing loading of more than 55 lb./sq. ft., even taking into account the Miles extensible flaps, which give a maximum lift coefficient of about 3 but that is for landing, and could scarcely be attained for take-off.

With 6,000 cu. ft. available for 50 passengers, an almost unlimited choice of cabin arrangement is obviously possible. The cabin is 16ft. wide and 8ft. high. One arrangement visualised makes use of three compartments, the forward being the main lounge, with accommodation for 34 passengers; the centre one is the dining and recreation room; and the aft cabin either a ladies' lounge or a smoking-room for 16 passengers. Here it may be mentioned that all fuel will be carried in the wings, so that smoking may be permitted anywhere in the cabins. An alternative arrangement has a longitudinal partition in the centre. The main lounge, it might be mentioned, is large enough for cinematograph projection.

100 Passengers, 2,000 Miles

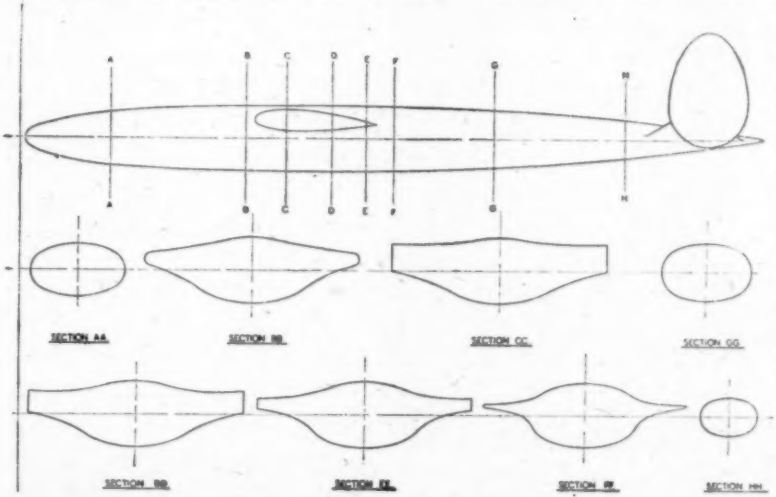
The medium-range version of the "X," with accommodation for 100 passengers, will have the seats arranged in two rows of three on each side of a central gangway, which itself is 4ft. wide and about 60ft. long. One layout has special seats arranged Pullman fashion, with tables between them on which meals and drinks can be served. At night the seats are arranged to form two-tier bunks.

Weight figures for the medium-range version do not differ greatly from those of the long-range type. Cabin furnishings are expected to weigh 10,000 lb. instead of 5,000, bringing the tare weight, equipped, up to 76,900 lb., and reducing the disposable load to 53,100 lb. This may be made up of 100 passengers and their luggage, 22,500 lb.; fuel (3,880 gals.), 27,900 lb.; oil (300 gals.), 2,700 lb.

There has been a good deal of argument about air freight and whether or not it is likely to become widely used. Be that as it may, calculations have been made for the Miles "X" as a freight-carrier. The bare weight, it appears, would be 65,000 lb. as before, but the absence of cabin furnishings would effect such a saving in weight that the disposable load would become 63,280 lb. after allowing 1,000 lb. for radio and automatic pilot and 720 lb. for a crew of four.

Again adopting the three versions long, medium and short range (3,450 miles, 2,100 miles and 1,000 miles), the respective freight loads would become 16,430 lb., 32,680 lb., and 47,880 lb. These figures are based on the assumption of an average headwind of 50 m.p.h. and, presumably, a cruising speed of 350 m.p.h. at 7,000ft.

The most astounding thing about the Miles "X" is, of course, its high cruising speed of 350 m.p.h. This indicates a remarkable "cleanness" of design; but, as we have already mentioned, wind tunnel and flying-scale model tests must be presumed to have proved the very low drag figure which must obviously correspond to such speeds and ranges. What these would mean in actual practice is, perhaps, best brought out by a few figures. The distance from the United Kingdom to New York is about 3,450 miles, and would be covered in 10 hours. Down Africa, to Johannesburg, is 5,920 miles via Lagos, which could be covered in a flying time of 17½ hours. The two stages would be of 3,120 miles and 2,800 miles respectively. Via Khartoum the distance is slightly greater, 6,100 miles; the stages would be 3,200 miles and 2,900 miles, and the total flying time 18 hours. Stages such as these would obviously call for the long-range version, but there are many distances between important centres throughout the British Empire for which the medium-range version could be adequate, with its greater pay load. It might even be that an intermediate version would do most of the routes necessary, except for the England-New York non-stop. There are not many places of importance more than 2,200 miles apart.



Transverse sections of the fuselage.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ROCKET RESEARCH

Air Density and Speed

THE article on "Rocket Research" in *Flight*, December 2nd, 1943, mentioned that the propulsive force obtained from a rocket is due to the reaction to the force ejecting the gas through the jet.

Is one to understand from this that the density of the atmosphere only affects the relative discharge velocity of the gas a higher gas speed being allowed by a lower density?

I must confess to having a very hazy knowledge of the subject, but I had always imagined that the greater the atmospheric density the greater the reaction obtained from a gas flow.

I should be glad to be enlightened. "DIM TYPE."

MERLIN MYSTERY

And Now Hercules, Too

CONCERNING the recent correspondence relating to mag-drops which have been accompanied by a kick on the throttle lever, I have had similar experiences on both Hercules and Merlin installations. When running a Hercules the spitting-back through the intake, which is often experienced when opening up a cold engine, will produce the same effect, and a slight kick can sometimes be felt when changing a Merlin supercharger into high gear.

In all these instances I have attributed it to a wave of back pressure in the induction system, caused by the sudden drop in revs and rise in boost, acting on the butterflies and along the control linkwork to the cockpit. The boost control does not, I believe, enter into the picture because the pressure wave is too sudden and short-lived to have any response from the aneroid and servo-piston.

There is an instance in the ground running of a Merlin, however, which can be attributed to the last-mentioned component and which invariably produces a violent kick. That is the operation of the boost cut-out control. In this case I think it is caused by a combination of butterfly and servo-piston movement.

One point on which I am inclined to differ from the other correspondents on the subject is the direction of the kick. In every case, except when moving the boost cut-out lever back to normal, I have found it to kick forward.

In closing, I would like to ask someone who really knows the answer to this question to give us the "gen" through the medium of your columns. There must be many readers with such knowledge, and yet it is not to be found in the average text-book. "FITTER IIE."

THEORY OF FLIGHT

To Jettison—or Not?

IN considering the effect on maximum gliding distance of an aircraft produced by jettisoning load in a forced landing, first let us examine the case under conditions of (A) no wind.

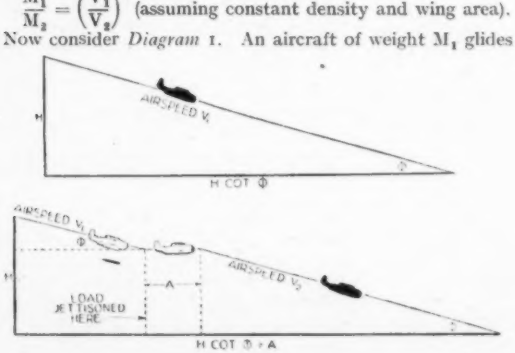
It is well known, and can be verified from any elementary work on aeronautics, that every aircraft has a definite gliding speed for which its angle of descent is a minimum. Further, if the aircraft weight varies from M_1 to M_2, then this "speed for flattest glide" varies from V_1 to V_2, where

$$\frac{M_1}{M_2} = \left(\frac{V_1}{V_2}\right)^2 \text{ (assuming constant density and wing area).}$$

Now consider *Diagram* 1. An aircraft of weight M_1 glides at its flattest-glide speed V_1 from a height H. In still air the distance covered is clearly

$$H \cot \phi$$

where ϕ is the best gliding angle.



In *Diagram* 2 the same aircraft glides as before from a height H, but on reaching a lower height h, it jettisons load, reducing its weight from M_1 to M_2, and thus reducing its flattest-glide speed from V_1 to V_2.

When the aircraft jettisons, however, its speed is V_1. To reduce speed to V_2 in order to continue the flattest possible glide, the pilot flies level a distance A, allowing his speed to decrease to V_2. He then puts the nose down and continues his glide at speed V_2, the gliding angle being the same as before, namely ϕ, since gliding angle depends only on L/D ratio, which is again at its maximum for the particular aircraft—(or may be *greater* if the load jettisoned was externally carried—e.g., a torpedo).

It now appears that the aircraft, by jettisoning load, has gained a horizontal gliding distance equal to A. The magnitude of A (distance covered while losing speed from V_1 to V_2) will depend on how great a speed reduction is being made, and on the characteristics of the aircraft (cleanness, etc.)—also on the average speed during the period.

Conclusion: For maximum glide in still air, jettison load. The point of jettisoning is immaterial if the load causes no drag.

Condition (*B*) *With Head or Tail Wind:* In this case the gliding distances will be diminished (for a head wind) or increased (for a tail wind) by a distance equal to

Total time of flight × wind speed.

This distance may be termed the *Wind Effect*.

In case I (no jettisoning)

$$\text{time of flight } T_1 = \frac{H}{V_1 \sin \phi} \text{ (see Diagram 1).}$$

In case II (jettisoning)

$$\text{time of flight } T_2 = \frac{H - h}{V_1 \sin \phi} \text{ for first descent;}$$
$$+ \frac{2A}{V_1 + V_2} \text{ for "float"—assuming an average speed;}$$
$$+ \frac{h}{V_2 \sin \phi} \text{ for second descent.}$$

That is, $$T_2 = \frac{H - h}{V_1 \sin \phi} + \frac{h}{V_2 \sin \phi} + \frac{2A}{V_1 + V_2}$$

This may be written:

$$T_2 = \frac{H}{V_1 \sin \phi} - \frac{h}{V_1 \sin \phi} + \frac{h}{V_2 \sin \phi} + \frac{2A}{V_1 + V_2}$$

Now $$T_1 = \frac{H}{V_1 \sin \phi};$$

$$\therefore T_2 - T_1 = \frac{h}{\sin \phi}\left(\frac{1}{V_2} - \frac{1}{V_1}\right) + \frac{2A}{V_1 + V_2}$$

Let wind speed be W.

Now Wind Effect, Case I = WT_1

Wind Effect, Case II = WT_2;

And gliding Distance, Case I = still air distance ± wind effect;

$$= H \cot \phi \pm WT_1;$$

Likewise, Gliding Distance, Case II = $H \cot \phi + A \pm WT_2$.

Excess Distance, Case II–Case I = difference of gliding distances.

$$= \pm WT_1 - A \mp WT_2$$
$$= W(T_1 - T_2) - A \text{ (Tail Wind)}$$
$$\text{or } W(T_2 - T_1) - A \text{ (Head Wind).}$$

Substituting in these for $T_2 - T_1$,

$$\text{Excess Distance} = W\left[\frac{h}{\sin \phi}\left(\frac{1}{V_2} - \frac{1}{V_1}\right) + \frac{2A}{V_1 + V_2}\right] - A \text{ (Head Wind)}$$

$$\text{or } W\left[\frac{h}{\sin \phi}\left(\frac{1}{V_1} - \frac{1}{V_2}\right) - \frac{2A}{V_1 + V_2}\right] - A \text{ Tail Wind)}$$

whence—

Jettisoning gives an increase or decrease of distance according as $W\left[\frac{h}{\sin \phi}\left(\frac{V_1 - V_2}{V_1 V_2}\right)\right]$ is greater/less than $A\left(1 - \frac{2W}{V_1 + V_2}\right)$ for Head Wind, or $W\left[\frac{h}{\sin \phi}\left(\frac{V_2 - V_1}{V_1 V_2}\right)\right] \gtrless A\left(1 + \frac{2W}{V_1 V_2}\right)$ for Tail Wind.

T. B. A. BOUGHTON (F/O.)

SERVICE AVIATION

H.R.H. The Duke of Gloucester inspecting a Stirling squadron of Bomber Command

Royal Air Force and Fleet Air Arm News and Announcements

Promotions

GENERAL DUTIES BRANCH.

Air Vice-Marshal R. M. HILL, C.B., M.C., A.F.C., is granted the rank of Act. Air Marshal. November 15th, 1943.

Air Commodores are granted the rank of Act. Air Vice-Marshal :—

T. W. ELMHIRST, C.B.E., A.F.C. November 6th, 1943.

V. E. GROOM, O.B.E., D.F.C. September 8th, 1943.

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards :—

For outstanding bravery and skill in many successful sorties against enemy shipping in the Mediterranean, while operating from Malta and North Africa :

Distinguished Service Cross

Lt. (A) R. I. W. GODDARD, R.N.

Temp. Sub-Lt. (A) W. N. JONES, R.N.V.R.

Temp. Sub-Lt. (A) D. A. MARCHANT, M.B.E., R.N.V.R.

Royal Air Force

THE KING has been graciously pleased to approve the following awards to the personnel indicated, who have completed, in various capacities, many successful operations against the enemy, in which they have displayed high skill, fortitude and devotion to duty.

Bar to Distinguished Flying Cross

Sqn. Ldr. J. R. ST. JOHN, D.F.C., R.A.F.O., No. 101 Sqn.

Act. Sqn. Ldr. G. R. HAY, D.F.C., R.A.F.V.R., No. 102 Sqn.

Act. Sqn. Ldr. D. E. STREET, D.F.C., R.A.F.V.R., No. 50 Sqn.

Flt. Lt. J. N. ROWLAND, D.F.C., R.A.F., No. 12 Sqn.

Act. Flt. Lt. F. S. COCKER, D.F.C., R.A.F.V.R., No. 161 Sqn.

Act. Flt. Lt. O. A CUSSEN, D.F.C., R.A.F.V.R., No. 161 Sqn.

Act. Flt. Lt. D. W. HENRY, D.F.C., R.C.A.F., No. 214 Sqn.

Distinguished Flying Cross

Act. Sqn. Ldr. D. A. BROWN, R.A.F., No. 7 Sqn.

Act. Sqn. Ldr. C. B. HESS, R.C.A.F., No 432 (R.C.A.F.) Sqn.

Act. Sqn. Ldr. A. J. MULLIGAN, R.A.F.V.R., No. 156 Sqn.

Act. Sqn. Ldr. D. SMITH, D.F.M., R.A.F.V.R., No. 90 Sqn.

Flt. Lt. R. FINDLATER, R.A.F., No. 109 Sqn.

Flt. Lt. A. R. GERSEKOWSKI, A.F.M., R.A.F.V.R., No. 100 Sqn.

Flt. Lt. D. MORTIMER, R.A.F., No. 427 (R.C.A.F.) Sqn.

Flt. Lt. J. H. MOUTRAY, D.F.M., R.A.F., No. 9 Sqn.

Flt. Lt. V. H. SURPLICE, R.A.F.V.R., No. 77 Sqn.

Act. Flt. Lt. G. T. BAILEY, R.A.F.V.R. No. 78 Sqn.

Act. Flt. Lt. N. BOWMAN, R.A.F.V.R., No. 109 Sqn.

Act. Flt. Lt. F. W. W. CHANDLER, R.A.F.V.R., No. 97 Sqn.

Act. Flt. Lt. K. S. GAZE, R.A.F.V.R., No. 78 Sqn.

Act. Flt. Lt. F. M. GRIGGS, D.F.M., R.A.A.F., No. 109 Sqn.

Act. Flt. Lt. J. D. HENDERSON, R.N.Z.A.F., No. 619 Sqn.

Act. Flt. Lt. F. T. HOPPS, R.A.F.V.R., No. 103 Sqn.

Act. Flt. Lt. J. HOUGH, R.A.F.V.R., No. 7 Sqn.

Act. Flt. Lt. F. C. MACDONALD, R.A.F.V.R., No. 620 Sqn.

Act. Flt. Lt. J. A. MORTON, R.C.A.F., No. 427 (R.C.A.F.) Sqn.

Act. Flt. Lt. E. H. MULLIGAN, R.C.A.F., No. 408 (R.C.A.F.) Sqn.

Act. Flt. Lt. T. ROWE, R.A.F.V.R., No. 77 Sqn.

Act. Flt. Lt. C. V. STEPHENS, R.A.F.V.R., No. 106 Sqn.

Act. Flt. Lt. E. A. STRANGE, R.A.F.V.R., No. 76 Sqn.

Act. Flt. Lt. R. F. TINKLER, R.A.F.V.R., No. 83 Sqn.

Act. Flt. Lt. P. G. R. WEEKS, R.A.F.V.R., No. 12 Sqn.

F/O. E. A. ADAMS, R.C.A.F., No. 97 Sqn.

F/O. T. G. W. BAYFIELD, R.A.F., No. 51 Sqn.

F/O. N. E. BEATTIE, R.A.F.V.R., No. 50 Sqn.

F/O. I. C. BECKWITH, R.C.A.F., No. 432 (R.C.A.F.) Sqn.

F/O. J. J. BERG, R.A.F.V.R., No. 100 Sqn.

F/O. N. B. BLAKEY, R.N.Z.A.F., No. 90 Sqn.

F/O. D. CARTER, R.A.F., No. 139 Sqn.

F/O. W. L. DARK, R.C.A.F., No. 432 (R.C.A.F.) Sqn.

F/O. A. FLEET, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.

F/O. S. E. Sukthanker, an Indian officer of the R.A.F. who received the D.F.C. at a recent investiture. He is also wearing the Pathfinders wings.

F/O. D. J. FURNER, R.A.F.V.R., No. 214 Sqn.

F/O. M. V. GOODMAN, R.A.F.V.R., No. 192 Sqn.

F/O. A. GRANT, R.A.F.V.R., No. 77 Sqn.

F/O. D. I. GRIFFITHS, R.A.F.V.R., No. 12 Sqn.

F/O. D. A. HICKMAN, R.A.F.V.R., No. 12 Sqn.

F/O. R. G. F. HUNT, R.C.A.F., No. 426 (R.C.A.F.) Sqn.

F/O. C. R. JOHNSON, R.A.A.F., No. 156 Sqn.

F/O. R. MASCALL, R.A.F.V.R., No. 138 Sqn.

F/O. V. W. G. MUSGROVE, R.A.F.V.R., No. 466 (R.A.A.F.) Sqn.

F/O. A. E. ROBBINS, R.A.F.V.R., No. 76 Sqn.

F/O. E. V. SANDERS, R.A.F.V.R., No. 12 Sqn.

F/O. F. A. SPILSBURY, R.A.F.V.R., No. 50 Sqn.

F/O. A. E. STOVEL, R.C.A.F., No. 139 Sqn.

F/O. G. L. WEAVER, R.A.F.V.R., No. 620 Sqn.

F/O. M. H. WHITBREAD, R.A.F.V.R., No. 7 Sqn.

F/O. L. V. WILLIAMS, R.A.F.V.R., No. 10 Sqn.

F/O. A. WOOD, R.A.F.V.R., No. 77 Sqn.

F/O. R. P. WRIGHT, R.A.A.F., No. 156 Sqn.

P/O. J. J. ALLEN, R.A.A.F., No. 466 (R.A.A.F.) Sqn.

P/O. F. BARKER, R.A.F.V.R., No. 61 Sqn.

P/O. B. R. BAYNE, R.A.F.V.R., No. 106 Sqn.

P/O. M. G. BROWN, R.A.A.F., No. 12 Sqn.

P/O. D. W. BURT, R.A.F.V.R., No. 97 Sqn.

P/O. J. H. CAMERON, R.A.A.F., No. 466 (R.A.A.F.) Sqn.

P/O. F. COUSINS, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.

P/O. J. H. CRIDGE, R.A.F.V.R., No. 158 Sqn.

P/O. D. A. DUNCAN, R.A.F.V.R., No. 50 Sqn.

P/O. W. H. EAGER, R.C.A.F., No. 61 Sqn.

P/O. H. ELLIS, R.A.V.R., No. 103 Sqn.

P/O. G. M. EWAN, R.C.A.F., No. 405 (R.C.A.F.) Sqn.

P/O. H. FAWCETT, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.

P/O. P. M. FOSTER, R.A.F.V.R., No. 78 Sqn.

P/O. S. N. FREESTONE, R.A.F.V.R., No. 199 Sqn.

P/O. N. GARDINER, R.N.Z.A.F., No. 12 Sqn.

P/O. J. R. GARDNER, R.A.A.F., No. 460 (R.A.A.F.) Sqn.

P/O. D. H. GLASSON, R.A.A.F., No. 466 (R.A.A.F.) Sqn.

P/O. K. D. GRAY, R.A.A.F., No. 101 Sqn.

P/O. K. HEWSON, R.C.A.F., No. 76 Sqn.

P/O. W. J. JOWERS, R.A.F.V.R., No. 9 Sqn.

P/O. F. J. KAUTER, R.A.A.F., No. 12 Sqn.

P/O. E. A. L. KEMP, R.A.F.V.R., No. 50 Sqn.

P/O. K. J. KINSELLA, R.A.F.V.R., No. 90 Sqn.

P/O. J. KOHUT, R.C.A.F., No. 7 Sqn.

P/O. A. R. J. LABERGE, R.C.A.F., No. 432 (R.C.A.F.) Sqn.

P/O. J. C. LANG, R.C.A.F., No. 51 Sqn.

P/O. G. B. LODER, R.A.A.F., No. 156 Sqn.

P/O. W. G. MCLELLAN, R.C.A.F., No. 101 Sqn.

P/O. L. A. MCMORRON, R.A.A.F., No. 466 Sqn.

P/O. M. R. NASH, R.A.A.F., No. 460 (R.A.A.F.) Sqn.

P/O. A. C. SHIPWAY, R.A.F.V.R., No. 83 Sqn.

P/O. C. W. SMITH, R.A.F.V.R., No. 620 Sqn.

P/O. H. STEPHENS, R.A.F.V.R., No. 161 Sqn.

P/O. E. J. STONE, R.A.F.V.R., No. 35 Sqn.

P/O. R. STOPANI, R.A.F.V.R., No. 49 Sqn.

P/O. S. W. TEMPLAR, R.A.F.V.R., No. 102 Sqn.

P/O. G. M. THORNTON, R.C.A.F., No. 427 (R.C.A.F.) Sqn.

P/O. J. WALKER, R.A.F.V.R., No. 101 Sqn.

P/O. P. WILBY, R.C.A.F., No. 7 Sqn.

P/O. H. P. WILLIAMS, R.A.F.V.R., No. 106 Sqn.

P/O. A. MCK. WOOD, R.A.F.V.R., No. 76 Sqn.

W/O. J. BORLAND, R.A.F.V.R., No. 12 Sqn.

W/O. S. C. I. BREMNER, R.A.F.V.R., No. 97 Sqn.

W/O. A. J. BROWN, R.A.F.V.R., No. 101 Sqn.

W/O. H. BRYSON, R.C.A.F., No. 97 Sqn.

W/O. W. V. CURRAN, R.A.A.F., No. 12 Sqn.

SERVICE AVIATION

W/O. A. L. D'EON, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
W/O. H. M. ELLIS, R.A.F.V.R., No. 61 Sqn.
W/O. A. R. HALES, R.C.A.F., No. 49 Sqn.
W/O. A. E. PINSON, R.A.F.V.R., No. 192 Sqn.
W/O. G. V. PRICE, D.F.M., R.A.F.V.R., No. 50 Sqn.
W/O. E. W. SMITH, R.A.F.V.R., No. 12 Sqn.
W/O. L. K. TEITZEL, R.A.A.F., No. 105 Sqn.
Act. W/O. P. O. BONE, R.A.F.V.R., No. 97 Sqn.
Act. W/O. G. CARPENTER, R.A.F.V.R., No. 35 Sqn.
Act. W/O. A. J. HARRIS, R.A.F.V.R., No. 97 Sqn.
Act. W/O. J. MORRISON, R.A.F.V.R., No. 49 Sqn.

Bar to Distinguished Flying Medal

Flt. Sgt. A. DICKINSON, D.F.M., R.A.F.V.R., No. 83 Sqn.
Temp. Flt. Sgt. W. F. W. PORTEOUS, D.F.M., R.A.F.V.R., No. 7 Sqn.

Distinguished Flying Medal

Flt. Sgt. D. A. J. W. BALL, R.A.F.V.R., No. 207 Sqn.
Flt. Sgt. G. G. BEALE, R.A.F.V.R., No. 61 Sqn.
Flt. Sgt. R. BROWN, R.A.F.V.R., No. 100 Sqn.
Flt. Sgt. E. F. BRYAN, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. A. H. CARLING, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. H. W. N. CLAUSEN, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. J. L. CRABB, R.A.F.V.R., No. 49 Sqn.
Flt. Sgt. S. MacK. DUNSHEA, R.A.A.F., No. 12 Sqn.
Flt. Sgt. W. J. EARLE, R.A.F.V.R., No. 199 Sqn.
Flt. Sgt. W. J. EVANS, R.A.F.V.R., No. 50 Sqn.
Flt. Sgt. F. FARNHAM, R.A.F.V.R., No. 192 Sqn.
Flt. Sgt. C. F. FRYER, R.A.F., No. 101 Sqn.
Flt. Sgt. W. L. GAUL, R.A.F.V.R., No. 51 Sqn.
Flt. Sgt. R. L. HAVIER, R.A.F.V.R., No. 50 Sqn.
Flt. Sgt. A. C. JONES, R.A.A.F., No. 97 Sqn.
Flt. Sgt. (now P/O.) D. JONES, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. R. A. LEAVERS, R.A.F.V.R., No. 199 Sqn.
Flt. Sgt. P. W. LEES, R.A.F.V.R., No. 103 Sqn.
Flt. Sgt. N. S. R. MCMINN, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. A. S. MILLER, R.N.Z.A.F., No. 12 Sqn.
Flt. Sgt. H. NELSON, R.A.F.V.R., No. 427 (R.C.A.F.) Sqn.
Flt. Sgt. A. T. NEWBEGIN, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. W. D. PINTCHES, R.A.F.V.R., No. 10 Sqn.
Flt. Sgt. W. A. PITT, R.A.F.V.R., No. 158 Sqn.
Flt. Sgt. D. B. POLDEN, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. J. C. POLLITT, R.A.F.V.R., No. 61 Sqn.
Flt. Sgt. K. E. POWELL, R.A.F.V.R., No. 158 Sqn.
Flt. Sgt. F. READ, R.A.F., No. 196 Sqn.
Flt. Sgt. S. RICHARDSON, R.A.F.V.R., No. 77 Sqn.
Flt. Sgt. S. W. ROGERS, R.A.F.V.R., No. 149 Sqn.
Flt. Sgt. J. C. ROSS, R.A.A.F., No. 156 Sqn.
Flt. Sgt. R. L. SKILLEN, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
Flt. Sgt. A. M. SMITH, R.A.F.V.R., No. 9 Sqn.
Flt. Sgt. R. H. WATFORD, R.A.F.V.R., No. 61 Sqn.
Flt. Sgt. W. R. WICKS, R.A.A.F., No. 12 Sqn. (since deceased).
Act. Flt. Sgt. W. R. J. DINGLE, R.A.F.V.R., No. 35 Sqn.
Sgt. A. H. L. ATKINSON, R.A.F.V.R., No. 76 Sqn.
Sgt. W. BERRY, R.A.F.V.R., No. 76 Sqn.
Sgt. R. BLAIR, R.A.F.V.R., No. 90 Sqn.
Sgt. J. T. BUNDLE, R.A.F.V.R., No. 97 Sqn.
Sgt. T. G. C. CHESHIRE, R.A.F.V.R., No. 50 Sqn.
Sgt. H. CORR, R.A.F.V.R., No. 77 Sqn.
Sgt. A. W. DAVIS, R.A.F.V.R., No. 76 Sqn.
Sgt. I. C. V. DOOLEY, R.A.F.V.R., No. 50 Sqn.
Sgt. (now P/O.) J. P. DUVAL, R.C.A.F., No. 427 Sqn.
Sgt. L. FOAT, R.A.F.V.R., No. 101 Sqn.
Sgt. H. W. GURTON, R.A.F.V.R., No. 10 Sqn.
Sgt. R. J. HAMILTON, R.A.F.V.R., No. 101 Sqn.
Sgt. J. HILL, R.A.F.V.R., No. 12 Sqn.
Sgt. J. HODGSON, R.A.F.V.R., No. 61 Sqn.
Sgt. J. HOOSTON, R.A.F.V.R., No. 75 Sqn.
Sgt. G. H. JONES, R.A.F.V.R., No. 76 Sqn.
Sgt. M. LIVINGSTONE, A.A.F., No. 138 Sqn.
Sgt. R. P. LLOYD, R.A.F., No. 101 Sqn.
Sgt. W. R. MCEWEN, R.A.F.V.R., No. 466 (R.A.A.F.) Sqn.
Sgt. W. MCN. MACPHAIL, R.A.F.V.R., No. 61 Sqn.
Sgt. J. F. G. MANN, R.A.F.V.R., No. 61 Sqn.
Sgt. J. MILLAR, R.A.F.V.R., No. 10 Sqn.
Sgt. G. D. B. MOORE, R.A.F.V.R., No. 12 Sqn.
Sgt. R. G. MORGAN, R.A.F.V.R., No. 76 Sqn.
Sgt. J. D. O'GORMAN, R.A.F.V.R., No. 101 Sqn.
Sgt. A. J. PAGE, R.A.F.V.R., No. 77 Sqn.
Sgt. V. A. REED, R.A.F.V.R., No. 78 Sqn.
Sgt. C. D. SHAW, R.A.F.V.R., No. 158 Sqn.
Sgt. A. H. SHILLCOCK, R.A.F.V.R., No. 76 Sqn.
Sgt. F. M. M. SMITH, R.A.F., No. 10 Sqn.
Sgt. R. K. STRATFORD, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
Sgt. E. G. SUTTON, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
Sgt. D. R. TATTERSALL, R.A.F.V.R., No. 12 Sqn.
Sgt. G. W. R. TAYLOR, R.A.F.V.R., No. 76 Sqn.

THE KING has been graciously pleased to approve the following awards:—

George Medal

Act. Sqn. Ldr. P. G. OTTEWILL, R.A.F.—One day in June, 1943, a Beaufighter aircraft crashed into an ammunition store when taking off and immediately caught fire. Both occupants of the aircraft were stunned and unable to get out unaided. Despite the bursting of the aircraft's war load of ammunition (which included cannon shells), the 30,000 rounds of ammunition which were exploding in the store and the grave danger of the petrol tanks exploding, Sqn. Ldr. Ottewill, accompanied by two others, went to the scene of the accident in an endeavour to rescue the crew. Sqn. Ldr. Ottewill, ignoring a burning petrol tank, jumped on to the wing and, after opening the front hatch, he succeeded in releasing the pilot and dragged him clear. Sqn. Ldr. Ottewill then returned and rescued the observer who was in a very dazed condition and oblivious to what had happened. Shortly afterwards a petrol tank exploded. Sqn. Ldr. Ottewill, who had been severely burned on a previous occasion when his own aircraft was shot down by the enemy, accepted the risk of further severe burns and injury in going to the assistance of his comrades and effecting their rescue. Fortunately he sustained only slight burns during this rescue.

Sgt. G. DAVIES, R.A.F., No. 202 Sqn.—In June, 1943, Sgt. Davies was the second engineer in an aircraft which crashed into high ground and immediately caught fire. Sgt. Davies, displaying complete disregard for his own safety, made many attempts to open a hatch, and eventually succeeded in releasing one of his trapped comrades whom he dragged to safety. Sgt. Davies then attempted to re-enter the blazing aircraft in an endeavour to rescue other members of the crew. He was, however, compelled to abandon the attempt owing to the intense heat which exploded depth charges in the aircraft.

A/C.1 D. OWEN, R.A.F.V.R.—In July, 1943, A/C. Owen was working in a bomb dump with six other airmen. He was engaged in attaching trolleys of bombs behind a tractor when a 1,000 lb. bomb in the dump exploded, killing five of the party and setting fire to a tractor and a portable crane. A/C. Owen, who was only a few yards from the airmen who had been killed, was badly shaken, but, ignoring the danger of further explosions, he immediately attempted to rescue another airman who was lying under a fiercely blazing vehicle. Although his comrade died as a result of injuries he succeeded in dragging him clear of the vehicle. Still disregarding his own safety, A/C Owen then drove a tractor and towed three loaded bomb trolleys away from the burning wreckage. This action probably saved further damage and injuries to personnel.

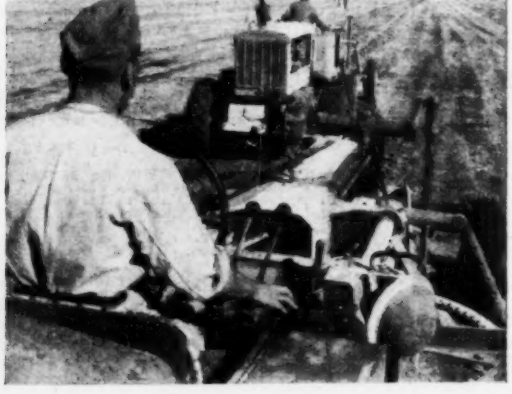
B.E.M. (Mil.)

Flt. Sgt. H. E. HALL, R.A.F.V.R., No. 214 Sqn.—One night in August, 1943, Flt. Sgt. Hall was pilot of a Stirling aircraft which was returning from operations. When approaching the south coast of England the aircraft ran out of fuel and dived almost out of control into the sea. The crew were temporarily knocked out by the impact and the aircraft filled rapidly with water. Flt. Sgt. Hall was the first to recover, and his thoughts were for the safety of his crew. He found the wireless operator injured and floating just below the astrodome, and in spite of the rapidly rising water and with complete disregard for his own safety, he succeeded in extricating him from the aircraft and securing him safely in a dinghy. He then returned to the aircraft to search for the navigator and flight engineer, who were missing. Five members of the crew were subsequently picked up by an air/sea rescue launch.

Flt. Sgt. W. J. NEILSEN, R.A.A.F., and Flt. Sgt. H. A. MCDONALD, R.A.A.F., both of No. 150 Sqn., and Sgt. R. W. COULSTON, R.A.F., No. 142 Sqn.—One night in June, 1943, one of a number of aircraft which had been loaded with bombs in readiness for an operation, caught fire. The bombs on board exploded and flaming masses of debris were hurled in all directions, setting fire to two other aircraft and much of the dry grass in the vicinity. Flt. Sgts. McDonald and Neilsen, a pilot and an air gunner respectively, immediately ran to a bomber which was almost surrounded by burning scrub, and, after starting the engines, taxied it to safety. Sgt. Coulston, a pilot, rushed to a bomber which was standing by the two which had caught fire, and although fully aware that the two burning bombers were likely to explode, proceeded to start its engines, thereby enabling the aircraft to be taxied away to safety.

Sgt. H. J. RHODA, R.A.F.V.R.—In June, 1943, Sgt. Rhoda was the wireless operator/air gunner in an aircraft which was forced down into the sea. This airman managed to extricate himself from the almost submerged aircraft, but, realising that some members of the crew were missing, re-entered the aircraft and successfully extricated the second pilot, who was unconscious and trapped. Sgt. Rhoda, being uncertain whether the navigator had escaped, then searched the fuselage but was unable to locate him. Throughout, Sgt. Rhoda displayed high courage and undoubtedly saved the second pilot's life.

Sgt. N. A. WORKMAN, R.A.F., No. 209 Sqn.—In June, 1943, Sgt. Workman was a member of the crew of an aircraft which crashed when alighting on the sea. The flying boat, which was about half a mile from the flare path, burst into flames. Although suffering from burns, bruises, cuts and shock, Sgt. Workman, disregarding his own safety, managed to lift one member of the crew into a gun position and to help another to a float. When the flames prevented him from rendering further assistance, Sgt. Workman made his way to shore in an endeavour to secure help. The half-mile journey involved wading through water waist deep, whilst hampered by weeds and mud. This airman displayed great determination and fortitude in his efforts to assist his companions, but unfortunately Sgt. Workman was the only survivor.



Scrapers of an Airfield Construction Group of the Royal Engineers levelling a runway site in Italy.

Air Chief Marshal Sir Arthur Tedder, Air C.-in-C. Mediterranean Air Command, at the wheel of the jeep which he uses for local journeys.

Roll of Honour

Casualty Communiqué No. 322.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 105 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. G. S. Bray; Act. Flt. Lt. J. E. F. Cowdrey; Sgt. H. Howarth; Sgt. A. W. Lake; Sgt. A. Lang; Sgt. P. J. Lyon; Sgt. G. H. Ordway; Sgt. G. W. Plummer; W/O. M. P. J. Scollin; F/O. V. A. Scott, D.F.C.; Flt. Sgt. H. E. Walker.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. F. J. Bowles; F/O. G. L. Hicks; Sgt. F. Taylor; Flt. Sgt. R. Watson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. L. A. Allan;

Sgt. R. S. Allen; Sgt. K. A. Amond; Sgt. A. Anderson; Sgt. W. Andrews; Flt. Sgt. R. Ashdown; Sgt. H. D. Baker; Sgt. G. Bell; Sgt. J. L. Bell; Sgt. H. E. Bradshaw; Flt. Sgt. F. J. Britton; Sgt. B. S. G. Bugg; P/O. C. S. Challoner; Sqn. Ldr. H. W. A. Chesterman, A.F.C.; Sgt. W. E. F. Clark; F/O. G. A. Clegg; Sgt. E. A. Cobham; Sgt. F. R. Cocks; Sgt. R. L. Colverson; Sgt. W. A. Cook; Flt. Sgt. J. R. Couper; Act. Flt. Lt. R. A. Curle; Sgt. E. R. Davidson; F/O. H. H. Day; Air Comdre. D. H. De-Burgh, A.F.C.; Sgt. W. D. Dorey; F/O. H. W. Dugard; Sgt. L. Ellis; Sgt. G. J. Evans; Sgt. A. J. Feenan; Sgt. H. M. Felce; Sgt. E. C. Fermanian; Sgt. R. F. Fowler; Sgt. R. A. Gerrard; Flt. Sgt. W. J. Ginger; F/O. W. R. Golding; Sgt. D. L. Gooch; Sgt. J. L. Graham; P/O. P. G. Harris; Sgt. D. A. Hart; Sgt. G. D. Hester; Sgt. J. E. W. Heydon; Sgt. G. M. Hill; Sgt. K. A. Holbech; P/O. S. M. Holliman; F/O. A. L. Holmes; Sgt. J. W. Hunt; Sgt. R. V. Jennings; Sgt. W. R. Jones; Sqn. Ldr. R. W. McCarthy; Flt. Sgt. T. A. Marsden; Sgt. G. Mitchell; Sgt. W. Moore; Sgt. J. L. A. Mulligan; Sgt. W. S. Murray; Sgt. R. R. Parry; P/O. C. W. V. Pepper; Sgt. J. W. Rider; Sgt. F. G. Savers; Sgt. C. J. H. Smith; Sgt. L. M. Stone; Sgt. R. E. Swift; Sgt. A. Telfer; Sgt. J. J. Thompson; Sgt. E. Tolson; Sgt. P. E. Trew; Sgt. J. N. Unsworth; Sgt. R. R. I. Webber; F/O. C. F. Williams; F/O. J. Williams; Flt. Sgt. G. E. Woodcock.

WOUNDED OR INJURED IN ACTION.—Sgt. B. Bennett; F/O. W. W. Spearey; Sgt. R. S. Trevvett.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. H. Brewer; Sgt. L. W. H. Butler; F/O. R. Christie; Sgt. R. Wild.

MISSING.—Flt. Sgt. J. E. G. Aston; F/O. K. A. Barber; Flt. Sgt. J. H. Barr; Sgt. V. H. Bartlett; Sgt. R. S. Bayly; Flt. Sgt. J. H. Benny; Sgt. G. A. Bicknell; Sgt. D. B. Bowen; W/O. M. R. Braines; Sgt. W. A. Brown; Sgt. R. E. Burgess; Sgt. J. G. Cavie; Sgt. F. G. Chilcott; P/O. A. B. Cocking; Flt. Sgt. R. G. Cole; Sgt. R. M. Coles; Sgt. R. A. Cordell; P/O. M. J. Coyle; Flt. Sgt. R. W. Dando; Sgt. A. Davidson; Sgt. K. A. F. Davison; F/O. J. J. Dawkins; Sgt. E. G. H. Day; Sgt. J. Dixon; Sgt. F. W. Dock; Flt. Sgt. J. F. Ellins; P/O. R. Ellis; Sgt. P. J. Elson; Sgt. D. M. R. B. Entwhistle; P/O. R. N. Faulkner; Sgt. N. Fleming; Flt. Sgt. J. D. Flyn; F/O. J. L. Foster; Sgt. P. R. Fox; Sgt. E. Fraser; Sgt. R. C. H. Freeman; Sgt. S. G. Gibbs; Sgt. L. Gientworth; F/O. S. C. P. Godfrey; Sgt. J. F. Gordon; Sgt. E. E. Greenfield; Sgt. T. H. Greest; P/O. D. G. Griffiths; F/O. J. A. Grundy; Sgt. H. N. Gustard; Sgt. E. J. Hall; Sgt. R. L. Harris; Act. Flt. Sgt. M. Haslegrave; Sqn. Ldr. R. Hawkins, M.C., A.F.C.; Flt. Sgt. G. Heath; Sgt. D. H. Hendry; P/O. G. E. Hickling; Act. Flt. Lt. J. D. Hill; Sgt. R. Hill; Sgt. A. E. H. Holmes; Sgt. E. W. Howell; Act. Flt. Lt. W. T. Irwin; Sgt. R. G. James; Sgt. E. J. E. Jarman; Sgt. D. J. Jones; Sgt. F. J. Jones; Sgt. S. J. Jordan; Act. Sqn. Ldr. J. H. Kennard, D.F.C.; P/O. T. C. Latham; Sgt. R. T. G. Lester; Flt. Sgt. W. B. MacKinley; Sgt. W. F. MacLaren; Act. Flt. Lt. C. B. T. McSweeney; F/O. E. S. Marsh; Sgt. R. G. Martin; Sgt. R. A. Metcalfe; Act. Flt. Lt. E. W. Mitchell, D.F.C.; F/O. G. E. C. Norman; Sgt. J. Norman; Sgt. T. G. Palgrave; Sgt. A. R. J. Parsons; F/O. G. G. Paul; Wing Cdr. W. M. Penman, D.F.C., A.F.C.; Sgt. H. Robertson; P/O. M. Root-Reid; Sgt. A. Rostron; Sgt. K. Saunders; Sgt. E. S. Sheppard; Flt. Sgt. B. A. Shortland; Sgt. R. A. Smith; Sgt. J. Spiers; Sgt. S. D. Stait; Flt. Sgt. D. Stanton; P/O. K. J. Stephenson; Sgt. J. H. Stevens; Sgt. J. D. Stewart; Sgt. J. P. Strachan; Sgt. P. C. Taylor; Sgt. R. M. Telfer; Act. Flt. Lt. D. L. Thomson; Sgt. J. Tunley; Sgt. C. R. Walker; Flt. Sgt. C. F. Walton; F/O. R. T. Watkinson; P/O. W. J. Watson; Sgt. S. H. Weakner; Sgt. N. E. Weighall; Sgt. W. W. A. Whalley; Sgt. L. H. V. Wiles; Sgt. D. L. Wilkie, D.F.M.; Act. Flt. Lt. D. A. C. Wilkinson, B.E.M.; Sgt. S. Williams; W/O. S. Woodhouse; Sgt. H. R. Wynn.

KILLED ON ACTIVE SERVICE.—A/C.2 J. Andrews; Sgt. L. Barker; L.A/C. D. H. Butcher; L.A/C. J. Chrystal; A/C.1 J. M. Crawford; F/O. E. J. Dorman; Flt. Sgt. G. M. Grossman; L.A/C. H. Hancox; F/O. A. H. Jackson; Sgt. J. Jackson; Sgt. E. J. Keightley; L.A/C. J. T. Key; Sgt. R. Lucas; Flt. Sgt. D. J. M. Martin; L.A/C. J. M. Morsman; Sgt. J. G. P. Prichard; Flt. Sgt. H. Shepherd; Sgt. J. G. Shepherd; Flt. Lt. R. Warburton.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. O. Gray.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. H. H. Steele.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. E. Beauchamp; L.A/C. E. Hanson; Sgt. A. W. Hill; L.A/C. F. A. Jaques; Sgt. W. A. Rickman; L.A/C. A. R. Skelson; Sgt. K. Wood; L.A/C. E. J. Wright.

DIED ON ACTIVE SERVICE.—A/C.1 S. J. Alexander; Act. Wing Cdr. J. E. W. Arthur; A/C.1 A. H. Boon; A/C.1 J. Harvey; L.A/C. W. J. Mapp; L.A/C. E. R. Silk; A/C.1 F. T. Stonier; L.A/C. J. G. Williams.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. H. Bacon; Sgt. E. W. Clay; P/O. W. Goodall; Sgt. E. W. Groom; Sgt. G. A. Johnston; Sgt. G. E. Kendrick; Act. Sqn. Ldr. K. N. T. Lee, D.F.C.; F/O. A. A. Norrie; P/O. E. H. Sandell; Sgt. S. Scott; Flt. Sgt. J. Stanhard; Sgt. E. W. Waterman.

Royal Australian Air Force

KILLED IN ACTION.—F/O. J. N. Scotton; Flt. Sgt. W. R. Wicks.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. J. Burns; Flt. Sgt. M. G. Delatorre; Act. Flt. Lt. B. F. Myers; Flt. Sgt. E. F. Stack.

MISSING.—F/O. D. Anderson; Flt. Sgt. R. E. Brook; F/O. B. A. Bunning; Sgt. H. Coldham-Fussell; Act. Sqn. Ldr. A. S. Cook, D.F.C., D.F.M.; Flt. Sgt. R. E. Dallwitz; Flt. Sgt. J. E. Francis; F/O. J. B. Gleeson; Flt. Sgt. L. C. Gomes; P/O. J. E. Hay; Flt. Sgt. S. E. Jackson; Sgt. P. L. Johnson; Flt. Lt. F. J. Lees; Flt. Sgt. J. G. Lockrey; Sgt. B. D. M. McDonnell; F/O. S. A. Morey, D.F.C.; P/O. H. G. Norton; Sgt. W. H. Powis; Flt. Sgt. C. R. Skerrett; Flt. Sgt. J. R. Speirs; Act. Sgt. B. E. Stehr; Flt. Sgt. J. S. Wilkins.

KILLED ON ACTIVE SERVICE.—Cpl. W. H. Blakeley; Flt. Lt. E. H. Griffith.

Royal Canadian Air Force

KILLED IN ACTION.—W/O. J. Walczak.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. A. Bailey; Sgt. J. F. Gubb; Sgt. R. E. Todd; Sgt. J. P. Young.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. P. O. Ethier; Sgt. A. F. Hopley; Sgt. T. F. How; Flt. Sgt. J. A. Ramsay; Sgt. J. A. Thomson.

MISSING, BELIEVED KILLED IN ACTION.—W/O. F. G. Maheu.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. G. Richardson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. A. J. Sochowski.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. S. B. Peryman.

MISSING.—Sgt. S. W. Ridler; Flt. Lt. W. B. Smith.

KILLED ON ACTIVE SERVICE.—F/O. L. T. Baker.

South African Air Force

KILLED IN ACTION.—2/Lt. J. H. Hynd.

MISSING.—2/Lt. K. W. Prescott.

Casualty Communiqué No. 323

Of the names in this list 58 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. L. P. Alexander; Sgt. T. L. Dickie; Sgt. J. D. Gulliver; Sgt. P. L. Hands; Sgt. T. C. Kerr; P/O. G. M. Hargrave; Sgt. S. Harris; P/O. L. Hogan, D.F.M.; Sgt. P. Meredith; W/O. K. F. Middlemist; Flt. Sgt. G. E. Penny; Sgt. W. J. Phillips; F/O. D. J. Polman; Sgt. W. Reeve; Sgt. T. H. Sharpe; P/O. D. W. Skipper.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. E. G. Bass; Sgt. D. Baxter; P/O. R. E. Bragg; F/O. T. Brown; Sgt. A. J. Gearing; Act. Flt. Lt. R. Grey; Flt. Sgt. J. A. C. Jacobs; P/O. R. F. Kingham; Sgt. R. D. Matches; Sgt. E. Pritchard; Sgt. G. G. Steer; Sgt. C. Stringer; Sgt. H. Walsh.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. Adams; Sgt. H. Beck; Sgt. J. Bell; Sgt. A. L. Bellerby; P/O. A. E. Brown; Sgt. T. J. Caveney; Sgt. L. J. Dodd; Flt. Lt. D. J. Donaldson; Sgt. H. W. Edwards; Sgt. P. J. Elton; Act. Sqn. Ldr. R. Eyton-Williams; Sgt. P. Ferguson; Sgt. W. Foley; Sgt. J. Gell; Sgt. M. B. Holden; Sgt. E. Holdsworth; Sgt. D. Holmes; Sgt. F. A. Hughes; Sgt. D. C. H. Hunt; Sgt. K. W. Keen; Act. Flt. Lt. R. T. Kenyon; Sgt. E. Kurring; Sgt. D. D. Laidlaw; Sgt. P. Lane; Sgt. P. H. Luscombe; Sgt. J. F. McFarlane; Sgt. J. A. Molloy; Sgt. F. S. Neal; Sgt. F. A. Neame; Sgt. K. Oatridge; Sgt. E. O'Kane; Flt. Sgt. D. K. Franklyn; Sgt. G. H. Rowson; F/O. G. D. N. Sanford; Flt. Sgt. R. C. Selby; P/O. A. R. Shepherd; F/O. E. A. Taylor; Flt. Sgt. A. G. Thomas; Sgt. T. Towle; P/O. R. W. Turner; Sgt. J. E. West; Sgt. R. Wiggins; Sgt. F. E. Williams; Sgt. R. Mck. Wylie; Sgt. A. R. York.

WOUNDED OR INJURED IN ACTION.—Sgt. L. Butler; Sgt. K. R. Cowgill; Sgt. W. G. Holt; Sgt. A. G. Owen; Sgt. R. C. Rigg; Sgt. H. E. M. Watson.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. E. A. Beecher; Sgt. R. A. Blackburn; Sgt. A. S. Burgess; Sgt. R. A. Clothier; F/O. L. E. M. Coote; Act. Sqn. Ldr. W. A. Cuddie; Sgt. C. Dickinson; Sgt. T. Duffy; Sgt. J. R. Haworth; Flt. Sgt. H. Lidgett; Flt. Sgt. A. McA. McKinlay; Sgt. D. Pickersgill; Act. Wing Cdr. G. A. Reid; Sgt. B. Royans; F/O. A. O. Stafford; P/O. S. R. Trill; F/O. D. S. Turner; Sgt. L. Turner; P/O. W. T. Waitt; Flt. Sgt. T. White.

MISSING.—Flt. Sgt. D. Abercrombie; Sgt. J. H. Anderton; Act. Wing Cdr. J. C. Archer; Flt. Sgt. F. J. Austen; P/O. F. R. S. G. Barker; Sgt. W. A. Beales; Sgt. L. G. Bender; F/O. C. J. W. Bevan; Sgt. F. Bloss; Sgt. G. Bown; F/O. A. C. Brace; Sgt. E. O. Bryant; Sgt. W. Buckton; Sgt. F. W. Cornwell; P/O. A. G. Corsby; Sgt. J. Curran; Sgt. A. Davis; Flt. Sgt. H. Deeny; Sgt. R. F. Devitt; Sgt. R. Diggie; Sgt. L. G. Doughty; Flt. Sgt. A. J. Edwards; Sgt. H. Entwistle; Sgt. J. Evans; Sgt. P. J. Flower; Sgt. A. D. Galloway; Sgt. H. E. St. H. Goom; Sgt. W. J. Grant; Sgt. C. J. Green; Sgt. T. J. Hall; Flt. Sgt. J. Hawkyard; F/O. S. G. Hoad; Sgt. R. Howarth; Flt. Sgt. R. J. G. Hyndson; F/O. O. B. James, M.M., D.F.M.; Sgt. C. L. Kingsnorth; Sgt. B. Kirkham; P/O. W. J. Leedham; Sgt. J. S. MacDonald; Flt. Sgt. W. H. MacDonald; Sgt. E. Magson; Sgt. L. P. Manley; Sgt. P. Mann; Sgt. E. G. J. Marsh; Sgt. K. Meredith; P/O. S. G. Mills; Flt. Sgt. A. F. H. Morris; P/O. H. E. Mosley; Sgt. F. E. Naylor; Sgt. L. W. Nichols; Sgt. A. J. N. Owen; Sgt. C. F. Paish; F/O. T. R. Pallet; F/O. R. W. Powell; Sgt. F. G. Reeson; Sgt. G. E. Reeve; Act. Sqn. Ldr. G. H. M. Riddell; Sgt. C. G. Rolph; Flt. Sgt. R. W. Smith; Flt. Sgt. F. Somerville; Sgt. W. R. Stables; Sgt. H. A. Stanworth; Sgt. F. Stothard; Sgt. A. Thomas; Sgt. H. L. Thomas; Sgt. K. W. Thorpe; Sgt. L. Tomlinson; Sgt. J. A. Town; F/O. R. H. J. Tozer; Sgt. B. Turner; P/O. S. T. Wariner; Flt. Sgt. W. G. Webster; Flt. Sgt. S. A. Whitby; Sgt. G. W. Wilkin; Sgt. A. E. C. Willig; P/O. G. W. Wilson; P/O. R. B. Woodhouse; Sgt. A. Yuill.

KILLED ON ACTIVE SERVICE.—Sgt. A. V. Andrews; Sgt. J. A. Baker; Flt. Sgt. K. Brigham; Sgt. W. F. Bristow; Flt. Sgt. W. C. Budd; Sgt. D. T. W. Cammies; Sgt. H. Dickson; Flt. Sgt. C. W. Fordyce; Sgt. R. C. Fowler; Sgt. W. E. J. Giles; W/O. J. T. Goozee; Sgt. C. A. Green; Sgt. C. A. Hughes; Sgt. R. G. Lees; Sgt. R. B. Morgan; Sgt. N. F. Paice; Sgt. G. S. C. Palmer; F/O. C. Parker; Sgt. G. Pearson; Sgt. W. S.

The library and reference room at an R.A.F. Station in the south west of England. The lady on the right obviously has good taste in literature.

SERVICE AVIATION

Robinson; Sgt. E. R. Rogers; Sgt. J. H. Rogers; F/O. J. P. Timmons; W/O. D. J. Williams; Flt. Sgt. W. F. C. Wisdom; Sgt. R. F. Worsey; A/C.1 G. Wright.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. Armstrong; Sgt. D. E. B. Bond; Sgt. P. M. Bowditch.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. R. L. Cooper; Flt. Sgt. W. G. Gregory.

DIED ON ACTIVE SERVICE.—A/C.1 E. W. Bates; L.A/C. R. W. Carbeck; L.A/C. T. Downie; A/C.1 S. Fennell; L.A/C. R. A. E. Frost; Cpl. L. Griffin; Sgt. A. E. Hughes; A/C.1 J. L. Nield; Sgt. B. J. Noakes; Cpl. N. W. Peate; A/C.1 R. Reeves; Cpl. L. D. Weston.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/C.2 K. M. Ffoulkes; A/C.2 V. Hughes.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. K. A. Langley; P/O. R. V. Liersch.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. P. Panos.

MISSING.—F/O. B. G. S. Bradley; P/O. H. W. G. Cockrem; Flt. Sgt. G. S. Hotchkis; Act. Flt. Lt. J. R. Jones, D.F.C.; Flt. Sgt. K. F. Lear; Flt. Sgt. E. N. Pettitt; Flt. Sgt. L. T. W. Sheldon.

KILLED ON ACTIVE SERVICE.—Sgt. J. E. Fraser; F/O. J. B. Watchorn.

Royal Canadian Air Force

MISSING, BELIEVED KILLED IN ACTION.—W/O. W. D. Brown; Sgt. E. J. Cooper; F/O. L. C. Pitman; Sgt. G. W. Speicher.

MISSING.—Flt. Sgt. W. H. Arnold; F/O. J. C. Austin; Flt. Sgt. R. M. Barlow; Flt. Sgt. G. V. Bartle; F/O. H. F. Beale; W/O. B. M. Berven, D.F.M.; F/O. D. S. Bier; P/O. C. R. Booth; P/O. G. R. Bourdon; F/O. K. C. Cherer; F/O. E. M. Cole; F/O. K. E. Cooper; F/O. J. Craig; P/O. R. E. Crewe; Flt. Sgt. B. V. Crist; F/O. C. L. Cullen; Flt. Sgt. J. E. Dayton; Sgt. R. Dempster; P/O. M. J. Dowd; F/O. J. E. Godwin; Flt. Sgt. J. P. C. Gordon; Flt. Sgt. R. T. Griffiths; P/O. W. A. Hadden; P/O. J. D. Hogan; Sgt. G. R. Jordan; Flt. Sgt. L. N. L. Kerr; Sgt. J. L. McAninch; W/O. A. R. Merritt; F/O. R. N. Millar; W/O. L. A. Munson; Sgt. W. Ness; W/O. P. E. Nichols; P/O. D. R. Parker; W/O. H. A. Pennell; Sgt. J. L. R. Rainville; Flt. Sgt. L. K. Raymond; Sgt. C. W. Renwick; W/O. R. W. Revell; W/O. K. G. Rolfstad; W/O. L. G. Smith; F/O. A. W. Ward; F/O. B. E. A. Vye.

KILLED ON ACTIVE SERVICE.—F/O. D. M. Anderson; W/O. G. B. Greenan; Sgt. G. H. L'Hommedieu; P/O. R. H. O. Mellor; Sgt. W. C. Reid; P/O. J. W. Wallace.

DIED ON ACTIVE SERVICE.—W/O. C. M. Howes.

Royal New Zealand Air Force

KILLED ON ACTIVE SERVICE.—P/O. J. F. Greenstreet.

Casualty Communiqué No. 324

Of the names in this list, 95 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. E. E. Chalk; Sgt. E. H. Fenning; Sgt. E. S. Foskett; Sgt. C. W. Holdsworth; F/O. W. Kemp; Sgt. E. G. Lane; P/O. J. T. Rogerson; Sgt. B. K. Short; Sgt. W. C. Smith; Sgt. F. O. Squibbs; Sgt. K. N. Taylor; Act. Flt. Lt. L. E. Thompson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. F. R. Burton; Sgt. J. Harrison; Sgt. S. B. Hawley; Sgt. T. J. Letbe; Sgt. A. Loudon; F/O. P. S. McCaughey; Sgt. E. J. Trezise; Sgt. H. Wakefield; Sgt. J. W. Young.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. A. Barker; F/O. N. Bird; Flt. Sgt. W. E. Boardman; Flt. Sgt. C. Bourne; Sgt. M. P. Brown; Sgt. S. H. C. Brown; F/O. V. G. Brown; Sgt. J. Bunce; F/O. S. C. W. Carlson; Sgt. B. J. Clinging; Sgt. H. C. Cope; Sgt. G. S. Crossan; Sgt. B. H. Cruikshank; P/O. G. Cruickshank; Sgt. R. G. Edwards; Sgt. D. G. Fairlie; Sgt. F. C. Fidgeon; Sgt. T. Gallagher; P/O. G. J. Gibbings; Sgt. J. Goddard; Sgt. J. N. Gray; F/O. A. J. Herriott, D.F.M.; Sgt. K. Hitchen; F/O. C. G. Hitt; Sgt. A. Howells; Sgt. N. Hudspith; Sgt. J. Hunter; Sgt. W. R. Jakeway; Sgt. W. Kinniburgh; F/O. R. H. Larkins; P/O. J. B. Lawrence; Sgt. J. E. Lecomber; Sgt. E. G. Litchfield; Sgt. G. S. Love; P/O. R. A. Parkinson; Sgt. E. H. C. Phillips; Flt. Sgt. J. H. Prior; Sgt. K. E. Rabbett; Sgt. A. S. Renshaw; F/O. H. Robertson; Sgt. G. C. D. Sayer; Sgt. A. G. Shum; Sgt. B. T. C. Smith; F/O. D. A. Sparrow; Sgt. J. R. Stone; Sgt. J. Strachan; Sgt. G. K. Thompson; Flt. Sgt. R. G. Thorne; Sgt. O. J. Trainor; Sgt. N. P. Tutt; P/O. A. Urquhart; Sgt. S. J. Vincent; Sgt. F. H. L. Vines; Flt. Sgt. R. Walton; Sgt. B. W. E. Wedderburn; P/O. G. G. Williams; Sgt. H. E. Williams; Sgt. H. R. Williamson; Sgt. A. G. E. Wilson; Sgt. J. B. Woods; Sgt. F. A. Worsnop.

WOUNDED OR INJURED IN ACTION.—Sgt. J. W. Birchall; Sgt. V. Garland; Sgt. K. V. Robinson.

MISSING, BELIEVED KILLED IN ACTION.—P/O. L. G. Heaney; Sgt. R. T. Johnson; Sgt. W. Quinn; F/O. B. Soulsby; Flt. Lt. R. F. Williams.

MISSING.—F/O. G. G. Banks; Sgt. A. S. Bissett; Sgt. R. Blanchard; Flt. Sgt. E. G. Boucher; F/O. J. A. Brett; Flt. Sgt. G. W. Bridgewater; Sgt. E. R. Burbage; F/O. P. A. Chappell; Sgt. C. A. Clark; Flt. Sgt. R. Cole; Sgt. W. F. Cox; Flt. Lt. C. A. F. Curwen; Flt. Sgt. R. E. Doddington; P/O. F. B. Edwards; Flt. Sgt. R. L. Fennel; Flt. Sgt. M. G. Fraser; Sgt. J. A. Gouk; Sgt. L. T. Graham; Flt. Sgt. A. Griffin; Flt. Lt. P. A. W. Gwynne; Flt. Sgt. M. F. Hall; Sgt. T. A. Hall; Sgt. J. Harkins; Flt. Sgt. A. Hayes; Sgt. E. Hill; Sgt. A. J. Hodgkins; Sgt. E. F. Hudson; Sgt. R. Kemp-Welch; Sgt. T. Lackenby; Sgt. G. F. Lawrence; Sgt. N. Lee; Sgt. R. Leybourne; Sgt. R. McDonald; Sgt. C. J. Massie; Sgt. M. Mensforth; Sgt. H. J. Middleton; Sgt. W. H. Milne; F/O. T. Mitchell; Sgt. H. Moorhouse; Sgt. R. Musgrove; Sgt. H. G. Packins; Sgt. L. Pew; Sgt. W. B. Ralph; W/O. H. W. Robinson; F/O. M. G. Sheerman; Flt. Lt. I. B. Small; Act. W/O. R. S. evens; F/O. E. E. Tatt; Sgt. J. C. Tetley; Sgt. E. Thorpe; Sgt. F. Tweedale; Sgt. D. Wigglesworth; F/O. C. J. M. Wilkie; Sgt. S. Wilkinson.

KILLED ON ACTIVE SERVICE.—F/O. O. Bechgaard; Sgt. J. F. Bickley; L.A/C. H. W. Booker; A/C.2 R. D. Brown; Sgt. D. Cawthorne; Sgt. W. R. Coster; F/O. J. Coughlan, D.F.M.; Flt. Sgt. W. A. Cruickshank; F/O. C. S. Dallimore; Sgt. L. L. F. De Vrye; A/C.2 K. T. Ding; F/O. J. H. Downs; Sgt. J. E. M. Gess; Sgt. J. O. Harvey; P/O. F. O. Hawkes; Sgt. C. J. Haycock; Act. W/O. G. Hilton; Flt. Sgt. J. Holden; L.A/C. J. L. Houghton; Sgt. D. Hunt; F/O. E. J. Jefferies; Sgt. J. G. Kelly; Sgt. M. C. Lang; Sgt. L. Langley; Sgt. C. A. Lockett; Sgt. M. D. Lumsden; L.A/C. A. MacArthur; Sgt. D. W. Meikle; P/O. R. Morley; W/O. T. B. Orford; A/C.1 R. E. Penn; A/C.1 H. R. Phillips; A/C.1 W. J. Pollard; Sgt. F. L. G. Price; Sgt. D. T. Ritchie; F/O. J. A. Robertson; L.A/C. J. G. Rynn; Flt. Lt. W. A. Shillitto, D.F.C.; L.A/C. R. G. G. Smith; P/O. E. R. Stead; Sgt. F. A. Sterry; A/C.2 D. A. Westcott; Sgt. R. Whitford; Flt. Sgt. D. I. Wildman.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. A. W. Gardner.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. B. Bridge; Sgt. J. Moran; Flt. Sgt. J. Turner.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. J. Shearer.

DIED ON ACTIVE SERVICE.—L.A/C. F. E. Anstey; A/C.2 D. Barnes; A/C.1 A. Buttery; A/C.2 J. C. Cain; A/C.1 W. H. Chambers; L.A/C. H. F. Draycott; L.A/C. K. W. Griffin; Sgt. W. G. Martin; L.A/C. R. F. Patterson; Cpl. H. Pountain; L.A/C. P. W. Shepherd; Cpl. L. J. D. Smith; L.A/C. R. J. Turner; Flt. Lt. W. L. Weager; A/C.1 R. J. Wicks.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. E. K. Cam; Flt. Sgt. D. E. Penn.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. A. H. S. Brown; Sgt. J. C. Daley; Sgt. H. V. Lamb; Act. Flt. Lt. O. G. Rowcroft; F/O. W. T. W. Smithson; W/O. M. P. Stewart.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. R. T. McCudden; Flt. Sgt. R. J. Rays; P/O. R. J. F. Vivers.

HALIFAX LOG: An original manner of keeping a record of operational journeyings. (Left to right) Iron Crosses (Berlin), Lifebuoy (Rescue search), Tankard (Munich), Tyre and Tricolour (Montlucon rubber works), Train (Mt. Cenis tunnel), Three Crowns (Hanover), Dachshund (Frankfort), Castle (Kassel), Lady's shoe (Dusseldorf.)

MISSING.—Flt. Sgt. T. P. Chadwick; P/O. J. Cohen; Flt. Sgt. M. H. Crossing; Flt. Sgt. C. C. Dacey; W/O. W. J. Doude; Flt. Sgt. G. J. Gebbie; Flt. Sgt. W. T. E. Highland.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. E. H. Berry; Flt. Sgt. H. E. Dennis; Flt. Sgt. P. D. Morrigan; F/O. A. T. Leydin.

Royal Canadian Air Force

KILLED IN ACTION.—W/O. G. H. Cockburn; Flt. Sgt. V. E. Cook; P/O. J. C. Findlay; Flt. Sgt. J. G. F. Fortin; P/O. G. H. Hamilton.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. H. D. Beattie; Sgt. C. L. Gerding; Sgt. R. E. Hart.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. F. T. Stanley; Sgt. G. Tyler.

WOUNDED OR INJURED IN ACTION.—Sgt. W. H. Cardy; Sgt. S. J. Everitt.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. A. Bortolussi; P/O. J. R. Dale; Sgt. E. V. Davison; P/O. T. J. Elliott; Sgt. E. H. W. Griffin; F/O. W. H. Hamilton; P/O. G. L. Hughes; W/O. J. A. Larocque; Flt. Sgt. K. A. B. McArthur; W/O. L. B. Mackay; P/O. S. McManus.

MISSING.—Flt. Lt. G. T. Berg; Sgt. A. J. Cadeau; Sgt. G. P. Columbus; Flt. Sgt. G. J. Crebbin; Sgt. R. A. G. De Pape; F/O. H. W. German, A.F.M.; P/O. R. P. Goldstein; Flt. Sgt. G. McM. Herbert; Sgt. J. Lundy; P/O. R. McGhie; P/O. L. C. Main; W/O. F. R. V. Nello; Flt. Sgt. C. Pennycook; Sgt. C. H. Wardrope.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. F. L. Kirkwood; P/O. J. W. Roussel.

KILLED ON ACTIVE SERVICE.—F/O. G. E. Adamac; W/O. J. F. C. Cabot; P/O. J. Christie; P/O. H. G. Dayman; F/O. T. M. Hawryluck; Sgt. C. F. Lee.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. H. D. Le Pointe; P/O. D. C. McGavin; Sgt. J. A. S. MacGregor; W/O. R. Tarling.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. G. McDonald.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Lt. E. C. Ball.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. O. E. Amos; P/O. A. M. Bridgman; Sgt. A. V. G. Cridge; Flt. Sgt. J. D. Gordon; Sgt. H. R. Harris; F/O. E. N. Jackson; P/O. H. R. Parker; W/O. A. M. White.

MISSING.—Sgt. C. H. Andrews; P/O. F. MacD. Poole; Flt. Sgt. B. J. Scholium; Flt. Sgt. J. Sutherland; F/O. J. G. Thomson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—W/O. T. R. Roberts.

South African Air Force

MISSING.—Lt. M. E. Bagg; Flt. Sgt. D. E. Bruyngo; Lt. D. G. Michel.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Flt. Lt. G. W. Minto.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Lt. R. E. Collender; Flt. Sgt. C. J. E. Golding.

Official Corrections

Casualty Communiqué No. 320.

Under "MISSING" delete Sgt. F. S. Dunn and Act. Sqn. Ldr. A. K. S. McCurdy, D.F.C. R.N.Z.A.F., under "MISSING" delete Act. Flt. Lt. R. B. Hesselyn, D.F.C., D.F.M.

Casualty Communiqué No. 321.

Under "MISSING" delete Sgt. R. G. Bentley R.A.A.F., under "MISSING" delete Flt. Sgt. E. J. Ellery and Flt. Sgt. J. O. Simpson.